The Journal
of the
Mysore Agricultural
and
Experimental Union.

Vol. VIII. Nos. 3 & 4*

After Twenty Years.

BY

LESLIE C. COLEMAN, M.A., PH.D.,

Director of Agriculture in Mysore.

I left Canada as nearly as I can now recollect on the 25th May 1905 and returned to my native land on the 1st October 1925. During the intervening period of twenty years I had been in Canada for short periods only in 1912, 1918 and 1923 but on none of these occasions had I made more than casual observations of the changed conditions which in truth were sufficiently startling to arrest the attention of even the most unobservant visitor.

In 1925 my position was quite altered. I had approximately two years' leave ahead of me, a period sufficiently long to enable me to learn something of the life of what had become practically a foreign country. Added to this the work I undertook brought me into close contact with two of the most interesting features of life in any country—the training of the country's youth and the production of the country's food. Of these two the latter seems to be a suitable subject for discussion in this Journal. As my time was spent entirely in Ontario, Canada's oldest and richest province, I shall confine my remarks to that part of the dominion. Even here I shall ignore that portion

* Published—June 1928.

of the province known as new Ontario, a country largely clothed with forest where pioneer conditions still prevail and where are to be found the immensely valuable ore deposits of gold, silver and nickel which have made Canada one of the richest mining countries in the world.

Old Ontario, as it is called, is a province roughly the size of Mysore with an agricultural history dating back not much over 150 years. It is peopled largely by the descendants of English, Scotch, and Irish immigrants, the more recent influx of population from other European countries having affected it much less than the younger provinces farther west. Although the province has developed at a very rapid rate industrially during recent years, still agriculture plays an important part in the life of the province. While I have no statistics by me I should estimate that still between forty and fifty per cent of the population live on the land. The holdings are, compared with parts farther west, small but except in the areas largely devoted to fruit cultivation and market gardening one does not often see a farm less than one hundred acres in extent. In the areas devoted to fruit growing there are holdings of less than twenty acres which are supporting fairly large families in moderate comfort. One such fruit farm of 19 acres with which I am particularly familiar supports a man, his wife and five children.

The actual conditions of country life have greatly improved since my youth. The motor car dwarfing distances as it does and the excellent paved roads that have followed enable the farmer to visit the nearest city practically at will and to return if necessary the same day. I should estimate that at least 90% of the farmers in Ontario have motor conveyances of some sort. There is now one such motor conveyance for every 11 people in the whole of Canada and the proportion in Ontario is probably about one to every seven or eight. Not only the farmer but the farm labourer or hired man, as he is still called, has commonly a motor car although he may have paid but one comparatively small instalment towards its purchase. In the house the telephone is practically universal. During my stay in Canada I heard of no farmer who was without what is now considered an essential to country life, and the various local phone systems are connected so that they form an amazing network over the whole countryside. Almost as universal as the telephone is the radio

which, conveying as it does the latest market reports each day, many farmers consider as an absolutely essential bit of equipment for the farm. Lastly there is the almost universally used and extraordinarily cheap electric power which provides lighting for the house and farm buildings and motive power for much of the farm machinery. All of these changes have drawn together the country and the town folk so that the line of separation which was so marked when I was a youth has now practically disappeared, for all these instruments of comfort and convenience have been introduced among the agriculturists during the past twenty years.

As to the actual farming operations themselves these have undergone, as one might expect, hardly as striking alterations and one at times wonders how the farmer is able to pay for all the comforts he now possesses. Rural indebtedness exists ; my work did not lead me to investigate the question but I doubt if it is now any greater than it was twenty years ago. The introduction of improved varieties of crops and the more general use of commercial fertilizer has undoubtedly led to an increase in outturn per acre. On the other the introduction of certain types of labour-saving machinery has led to the reduction of production costs but this reduction cannot be very striking. Although the horse has been practically banished from the roads, he remains the main source of motive power on the farm itself. Tractors are a comparative rarity except in the fruit belt where they are rather commonly used for cultivation purposes in orchards and vineyards.

The chief changes in farm machinery have been in the way of designing larger and better horse-drawn implements so that one man can direct the motive energy of three or four horses instead of only one or two. In my youth in Ontario the three and four horse team was rather a rarity, its use being practically confined to the hauling of a grainbinder. With increased wages has come the necessity of using more economically the labour force, hence the introduction of more efficient implements. The grainbinder and the mower were of course in use long before I left Canada but the size has considerably increased. The same may be said of the seed drill. Implements such as manure spreaders, hay loaders, potato planters, which were not often seen in Ontario in my days, are now very common.

Common is also the use of protective measures against insect and fungus attack. No commercial fruit-grower in Ontario or for that part, in North America would now think of leaving his orchard unsprayed. Twenty years ago the man who sprayed his orchard was the great exception. Perhaps there is no more striking instance of the help that modern science gives to the Canadian farmer than that of the protection of fruit against diseases and pests. I shall give but one instance as an illustration.

Apples which form perhaps the most important fruit crop in Ontario are attacked by a serious disease, apple scab, which while not destroying the fruit very greatly decreases its sale value. An immense amount of research work has established pretty definitely the conditions favourable for the outbreak and spread of this disease and the means necessary for its control. As might be expected rainfall in the spring is the chief factor in starting it going and the first protective spray has to be put on before the first rain that occurs after growth has commenced. The Departments of Agriculture have a definite organization to keep track of the development of the disease and to tell the growers just when and how to spray. Daily weather reports received from the weather bureau are utilized in deciding just when a particular spray should be applied and definite information is telephoned to the farmers concerned. This is followed up by the issuing of circulars giving directions as to just when and how to spray. The use of power-driven sprayers has become practically universal in the fruit-growing areas and the spraying operations form one of the main features of fruit cultivation.

Another marked change that is to be noted in country life in Ontario is to be found in the education of the children. When I was a country lad, primary education in rural schools had no point of contact with the environment. The teachers commonly came from the towns and knew little and cared less about rural life and rural occupations. In the training of these teachers no attempt was made to give them any instruction which would help to remedy this defect. Now the position has greatly altered. There is a definite organization in the Education Department to develop in the rural teachers and through them in the rural schools an intelligent understanding and interest in rural life. In my report on Agricultural Education published in 1913 I noted the beginning of this movement.

During my stay in Canada I took the opportunity of discussing with Dr. J. B. Dandeno, Director of Primary Agricultural Education, the present situation and the progress. I found that definite work of this kind is now being carried out in more than 2,000 rural schools in the province through definite classes, school gardens, school fairs and so-called "home project work". The training of teachers in a series of special courses in the agricultural college and the agricultural schools of the province has also been continued and expanded.

This account does not exhaust my impressions of the changes that have taken place in Ontario agriculture during the past twenty years but it may serve its purpose, for I can see no great reason why changes of even greater moment may not be ahead of us in Mysore. While it may be long before motor cars become general among our agricultural population still the advent of motor buses is serving the same purpose of bringing together the town and the country. Improved implements and improved seed are being adopted by the ryots to a steadily increasing extent. A commencement in the utilization of electric power on the farm has already been made and I anticipate rapid developments in this direction. The use of commercial fertilizers has received a marked stimulus from the establishment of propagandist agencies and manure depots by private firms throughout the State. I expect within the next twenty years, if I live that long, to see spraying almost as universal among the coffee planters and areca garden-owners in Mysore as it is on the fruit farms of Canada to-day. Finally, an earnest attempt is being made by our Education Department to adapt rural education to rural needs and who will say what twenty years may bring forth in this direction ? Despite the croaking of confirmed pessimists and the uninformed statements of politicians, the economic status of our ryot population is being steadily raised and I believe we are on the threshold of infinitely better things for our great basic industry.

Large-Scale Trials of Artificial Manures for Paddy on Private Lands.

BY

B. Narasimha Iyengar, B.A., Ph.D.,

Agricultural Chemist.

Owing to a large extension of irrigation during recent years under the Krishnarajasagara or the Kannambadi Reservior, extensive areas of land which were formerly growing dry crops such as jola and ragi have now been converted into paddy fields. In a very large number of these tracts newly brought under irrigation, there is a scarcity of manure of any kind, either farm-yard manure or green manure, and consequently the yield of paddy per acre is rather low. A good many people who own lands in these tracts are absentee landlords as well, and usually their lands are cultivated by the local ryots on the "Varam" or share system. One of many such landlords was not getting more than a total yield of three hundred seers of paddy per acre and out of it one-half had to be given to the cultivator as his share. Having tried sulphate of ammonia as a stimulating manure for sugarcane on some of his lands near Bangalore with satisfactory results, he wanted to find out if the yields from his paddy lands under the Krishnarajasagara could not be made satisfactory and profitable by the application of suitable artificial manures, and asked my advice and help in the matter in the early part of 1924.

The lands are about 27 and odd acres in extent in one compact block and are situated near Hampapur in the area newly brought under irrigation below the Mandagere channel of the Krishnarajasagara Works. The whole area has been divided into 25 plots varying in size from 20 to 74 guntas and is cultivated on the "Varam" system by 14 ryots.

The nature of the soil being mostly sandy and gravelly and organic manures of any kind—either farm-yard or green manure—being scarce in the locality, it was thought advisable to use oil-cakes as a source of nitrogen when making up the mixtures needed. Various paddy mixtures were tried during the first year but as the work was found to be too complicated to be put through efficiently to the satisfaction of the landlord, tenants, and ourselves as well, work during the

other three years was confined to the trial of a single mixture consisting of groundnut cake, castor cake and ordinary superphosphate in certain proportions and applied at the rate of 3 cwts. per acre just before transplanting. The mixture itself consists of 3 parts of groundnut cake, 3 parts of castor cake and 4 parts of ordinary superphosphate. The quantity of the mixture used as manure supplied about 12 lbs. of nitrogen and 20 lbs. of phosphoric acid to the acre. The cost of the mixture applied varied between Rs. 25 to Rs. 22 per acre in the various years according to prices of materials used.

The yields from individual plots for the four seasons during which the work has been in progress, are given in the statements and the average results in the four years of experiments have been as follows :—

Year	Average yield per acre
1924—25	.. 878 seers of paddy.
1925—26	.. 924 do.
1926—27	.. 964 do.
1927—28	.. 1,267 do.

The average yield per acre in previous years before the application of manures was only 300 seers of paddy and may be taken as what the land can yield without any manure at all or as the yield from check plots if any such had been left.

From the figures given above it will be seen that the average yield has almost trebled itself during the very first year of manuring. During the next two years the yield shows a slight increase but not a very appreciable one. It may be due to the general unfavourable conditions of the season at the time of flowering complained of in the locality. Seasonal conditions brightened up a bit in 1927—28 and there were the usual showers of rain at the time of flowering. The bettering of the seasonal conditions seems to have enabled the plots to utilize the manure applied to a greater extent than before, resulting in an increase of nearly 50% over the produce of the first year. During the 4 years, the yields of these plots have gone on continuously increasing while the neighbouring fields belonging to ryots and cultivated with very little manure gave only poor yields, not exceeding 400 seers of paddy per acre.

The general variations in yield during the different seasons have been as follows :—

Year	Yield of paddy per acre	
	Highest	Lowest
1924—25 ..	1,085 seers	460 seers
1925—26 ..	1,173 ,,	476 ,,
1926—27 ..	1,187 ,,	636 ,,
1927—28 ..	1,620 ,,	1,056 ,,

It is seen from the above figures that the highest yield in 1927—28 is 60% more than that in 1924—25. During the same period, the lowest yield has increased from 460 seers in 1924—25 to 1,056 seers in 1927—28, *i.e.*, by nearly 250%.

It is needless to state that an increase in grain has been accompanied by an increase in straw as well. Till now, the landlord himself has borne the entire cost of manures used and the tenants have been getting the benefit of the manuring without any expenses on their part. This has, of course, reduced the profits of the landlord to a considerable extent, but that is a matter to be mutually agreed upon between the landlord and the tenants.

Incidentally, the work shows what an intelligent, enterprising, capitalistic, absentee landlord can do to increase agricultural production in the country, thereby benefiting himself and his tenants as well.

Table showing *calculated* yield of paddy from various plots during 1924—28:—

Plot No.	Area in guntas	Yield of grain in seers per acre			
		1924—25	1925—26	1926—27	1927—28
1	74	789	900	897	1,270
2	50	1,085	957	1023	1,228
3	44				
4	74	1,073	1,163	1,097	1,267
5	74	969	1,173	1,187	1,391
6	41	569	1,105	1,013	1,475
7	22				1,620
8	41				1,300
9	41	968	1,114	1,150	1,238
10	48	867	1,008	1,058	1,094
11	35	782	1,074	1,099	1,121
12	33	722	943	909	1,278
13	49	831	1,029	842	1,249
14	23	978	1,120	1,008	1,346
15	22				1,227
16	41	943	878	872	1,221
17	20	477	916	864	1,188
18	32		755	1,130	1,552
19	82	547	813	927	1,335
20	42				1,069
21	20		648	636	1,230
22	58				
23	32	460	476	712	1,175
24	30		720	773	1,157
25	64		669	891	1,423
Average for the whole area		878	924	964	1,267

Table showing *actual* yield of paddy from various plots during 1924—28.

Plot No.	Area in guntas	Yield of grain in seers per plot			
		1924—25	1925—26	1926—27	1927—28
1	74	1,460	1,666	1,660	2,349
2	50	2,550	2,248	2,404	2,886
3	44				
4	74	1,985	2,152	2,030	2,344
5	74	1,792	2,170	2,196	2,574
6	41				
7	22	1,480	2,872	2,633	1,512
8	41				891
					1,332
9	41	992	1,142	1,179	1,269
10	48	1,040	1,210	1,270	1,313
11	35	684	940	962	981
12	33	596	778	750	1,054
13	49	1,018	1,260	1,031	1,530
14	23	1,100	1,260	1,134	774
15	22				675
16	41	966	900	894	1,251
17	20	620	458	432	594
18	32		504	904	1,242
19	82	1,640	2,520	2,874	2,736
20	42				1,069
21	20		324	318	615
22	58				1,531
23	32	1,380 (3 acres)	1,072	1,602	940
24	30		540	580	858
25	64		1,070	1,426	2,277
Total for 27 acres and 12 guntas, in seers.		19,303 (22 acres)	25,186	26,272	34,597

Fodder and Drought.

BY

M. G. Rama Rao, B.A.,

Retired Conservator of Forests.

The system of cultivation in Mysore is such that there is practically no place for fodder crops in rotation. Though the main source of power for farm operations is cattle, hardly any serious attention is paid to secure an adequate supply of fodder to maintain the live-stock on the farm in good condition. Even during normal years when drought lasts for several months during summer, live-stock of all kinds run down in condition, and in many cases the animals merely prolong their lives in the hope of getting early rains and natural green verdure. So long as we depend for fodder entirely upon the refuse of the farm produce in the shape of straw of various crops, the present unsatisfactory state of affairs will continue to prevail in the country where the bulk of the cultivators depend upon timely and sufficient rains for raising successful crops.

During periods of water and fodder famine, when the crops fail and there is not even a vestige of verdure anywhere in the country, the position of the live-stock is simply pitiable. Malnutrition and want of drinking water weaken their system and thousands fall victims to the ever-lurking cattle plagues and diseases. The horrors of the great famine of 1876—77 are still within the living memory of many.

Partial or entire failure of rains in isolated localities have caused grave anxiety to the Government on several occasions since then. The recent fodder famine of 1923—24 in the eastern part of the State found us unprepared to take the situation well in hand. In spite of the exertions of the various departments, one cannot say that the situation was well met, or the measures adopted were entirely satisfactory. Now that the timely rains in 1926 saved the country from a similar situation, we have again slipped back into apathy. As this kind of spasmodic efforts to meet grave situations when they arise are useless, the question as to how we can free ourselves from the horrors of periodic famines requires to be considered seriously.

So far as the supply of food materials is concerned, there is no danger of people dying of starvation. Mysore is no longer isolated.

Through its railway communications and well-laid roads, any quantity of food materials can pour in from other parts of India. But can we get the necessary supply of fodder? And even if we get it, only those who have had the experience know how hard it is to take it to the needy places for distribution. Driving cattle to places where fodder is available in plenty has also been tried and we have grown wiser by that experience. Let us make a brief survey of the available sources of fodder, and what happens if the rains fail and there are no crops to harvest.

Nature has blessed Mysore with many natural advantages. Her situation within the influence of two monsoons, her elevation and a fairly fertile soil, have made her a prosperous agricultural and pastoral country. It is only the vagaries of rainfall that are mainly responsible for many an awkward situation. The wisdom of the people of Mysore has tried to overcome this natural disadvantage by constructing wonderful chains of tanks and digging miles of irrigation channels from her perennial rivers. Places thus protected have not much to fear; nor are the localities situated near forests and Amrit Mahal reserves. But in the maidans or wind-swept open country, when the rains fail, the tanks are dry and there are no crops to harvest, the cattle are left without water and fodder. The *gomal* lands are more often than not barren wastes of rocks or hardened laterite uplands without any kind of edible herbage on them, save for isolated groups of *Bandarike*, *Thangadi*, *Kare* or Lantana.

What then is our duty? And how can we remedy this situation? It is here we have to look to other forward countries for inspiration and follow their lead. In South Africa, they have made an elaborate study of native vegetation in various localities with a view to discover the merits and demerits of the desert plants. The report of the Commission is full of practical suggestions. In New Zealand, with Government aid, they are improving the pastures by manuring with phosphates and by encouraging the more useful plants to increase. In Denmark, thousands of square miles of moor-lands have been reclaimed by draining and liming. They have taken it up as a national concern. In the eastern counties of England, in Holland and Belgium, shallow seas have been reclaimed for raising immense areas of rich pasture. In the United States, there are

special departments of the State to tackle these problems. They are reclaiming saline soils and their agents are always travelling all over the world, in search of new and better plants for their fields. Neither the regions of Lake Tohad in the Sahara nor the uplands of Mongolia are too far for their intrepid explorers to secure useful plants for their country. In Australia, the quality of their wool depends upon the natural herbage of their sweeping plains, and the Federal Government is always alert on maintaining and improving their condition. They have attained these results by dint of hard work. Research and organization are mainly responsible for their success. How far have we made use of these two weapons to solve our problems?

That research should aid us, was seen very early by our statesmen. The scientific departments started by them a quarter of a century ago have silently worked and accumulated much valuable information. It is now left to us to utilize the fruits of their researches and use them to solve many problems that still await solution. It is only by intense research, accurate observation and critical experiments, can we take the right line of action. Otherwise, much time, labour and money would be diverted to unproductive exertion.

From the available publications we can gather much valuable information regarding what has been done so far. Dr. Voelker who travelled in Mysore, nearly 50 years ago, said that Mysore soils were deficient in lime and humus. Dr. Lehmann, the first Agricultural Chemist, by numerous analyses, showed that our laterite soils are deficient in phosphoric acid also. He imported a large number of grasses and legumes from Europe and America and tried them here. He found that the exotic ones were not suited to our conditions and so he looked to the utilization of indigenous crops and other plants for improvement. Famine foods and various fruits and leaves of trees were also examined for their feeding value. It was found that many of them were quite valuable. Further work of the Agricultural Department in this line has resulted in the isolation of many indigenous grasses, and these have been tested for their feeding value. Fodder crops of cow-pea, sunn-hemp and sun-flower have been successfully raised. Palatable and succulent ensilage has been made from

various legumes and grasses and their value clearly demonstrated. Ensilage is now freely used on some dairy farms to great advantage. The Economic Botanist has, from time to time, imported several foreign grasses of which Rhodes grass has been successfully grown in Bangalore. Yet we are far from solving the fodder problem satisfactorily. The fruits of their labours have not been taken to the doors of the cultivators. Publications of the departments are sufficient to enlighten the educated and informed, but a more organized, intense and intelligent propaganda is required to educate the illiterate cultivator to reap the benefits of scientific investigation.

Anyone who has seen the greater part of the State knows that there is no area which is quite barren. Even hard sun-baked laterite soils, when once broken and planted with trees would, in time, bear tolerably good forest and later a moderate herbage on the ground. Avenue trees along the roads bear testimony to the plant-bearing capacity of the Mysore soils. The casuarina plantation in Bangalore Palace grounds shows the capacity of the laterite soil to bear vegetation clearly. The untouched land round the Yelhalsikara tower is still bleak and barren. The existing forests in Mysore, the avenue trees, and isolated plantations in the Maidan parts indicate to us the possibilities of utilizing the sub-soil moisture. Even on the high ridges, a large amount of sub-soil moisture is available to maintain a forest growth. To me it seems that the future of the State depends upon this sub-soil moisture. Grasses generally tap the sub-soil to a depth of 2 or 3 feet and some of the coarser ones to a depth of 4 or 5 feet, and during drought they fail to get water and consequently die out whereas trees which have deep tap-roots are independent of these surface variations of moisture content. They are not generally affected unless a series of years in succession happen to be abnormal. Even then they do not entirely wither and die. Therefore it seems to me that in the exploitation of the tree-flora having edible leaves and fruits lies the solution of fodder supply during droughts.

There are many indigenous trees like *Atthi*, *Goni*, *Basari*, *Ala*, *Nerale*, which bear edible leaves. I have seen many more forest leaves eaten by cattle. In the dry parts of Chitaldrug and Tumkur districts, especially near Bukkapatna in Sira, and in Huriyur and Molakalmuru Taluks, there are extensive forests of *Kavara* or *Karachi*

(*Hardwikia binata*) the young shoots and leaves of which are very extensively used for fodder. Leaves of *Hutcha Bevu* or *Taraku Bevu* are said to be useful for milch cows, sheep and goats. There are some big trees like *Albizzia lebbeck* (Bagi), *Albizzia stipulata* (Hotte bagi) and *Odina Wodier* (Udi or Simti) the leaves of which are relished by cattle. Leaves of *Erythrina* and *Sesbania* are freely used for feeding cattle. Mulberry affords a very palatable fodder. Many of these grow luxuriantly in tank beds, along water courses and channel embankments. If they are planted in large numbers, they would afford thousands of tons of green, nutritious herbage during dry seasons and droughts. In the Hawaii Islands, the problem of fodder became acute as the water table began to sink. But the planting of *Prosopis juliflora* has altered the situation and converted the barren plains into green forests with buzzing bees and roamed by fat cattle. The pods feed the cattle and the bees provide tons of honey. I hear that Dr. Kunhi Kannan has introduced this tree from Hawaii and it has been successfully grown by the Department. We have an allied species in *P. spicigera*. Yet one more instance. In North India they have begun to prepare good ensilage from *Dalbergia sissoo* leaves. We have not only this, but also others related to this in Mysore, *viz.*, *D. latifolia*, *D. lancelaria*, *D. paniculata* and *D. monosperma*. I have sufficiently indicated the wealth of Mysore flora awaiting exploitation for providing nutritious green fodder or well-made ensilage. The leaves of these are more nutritious than the straws of cereals which are our mainstay. It is hard for one to imagine the huge amount of leaf fodder available in the country if miles and miles of our canal embankment, vast areas of tank-beds and dreary regions are planted with suitable plants and preserved as an insurance against famines.

Exports of large quantity of oil-seeds, cocoanuts, and oil-cakes diminish the supply of feeding stuff. We should organize to retain our oil-seeds, crush them locally and send out only oil in which case, a large quantity of concentrated feed will be always available in the country during droughts.

The Forest Department comes in close contact with the raiyats and they are helping them in many ways. All the grass in the reserved forests is now going to waste. In good season and bad, large

quantities of straw may be kept as a reserve. Preparedness for every contingency should be our watchword. The value of such a preparedness cannot be appreciated in normal times. The recent floods in Gujarat have washed villages, cattle, stores and fodder. Before the next crop is harvested there is no fodder, but the Government have in stock good fodder of 205 lakhs of lbs. ready at Godhra, Dohad and Palghar. In addition to these, further quantities are available. Can we claim such preparedness ?

My suggestion is that a permanent Committee which would include experts from the various departments and some non-officials should be appointed. It should be the duty of the Committee to explore the various aspects of the fodder problem, organize work and carry on the work efficiently. I may here suggest that a part of the interest on the "Famine Reserve" may be appropriately made available for this important protective work.

I have briefly indicated the various aspects of the fodder problem. In conclusion, I would suggest that the suggested enquiry may include the following subjects:—

(1) Bringing together all the facts known about the famines in Mysore with a view to locate the areas which are prone to famine conditions, the manner in which the situation was dealt with, the expenditure involved and the results.

(2) Preparation of detailed meteorological maps to show the areas having the same amount of rainfall and similar weather conditions.

(3) A grass and herbage survey of areas in the State.

(4) A survey of edible forest leaves and fruits.

(5) Introduction of drought-resisting fodder-plants from foreign lands and testing them in typical localities.

(6) Forest Nurseries and Seed Depots to supply seeds and plants useful for fodder.

(7) Opening of plantations of edible forest trees in the dry tracts of the State. (Every village may have its *gomal* lands planted. This may be entrusted to the Village Panchayets.)

(8) Opening up silo-pits and stocking fodder in compressed bales in reserved forests.

(9) Examination of the feeding values of various plants and fodders under investigation.

Raising fodder plantations in the dry tracts will not only secure a sufficient supply of fodder during famines but will also have other influences. A large quantity of sub-soil moisture will be retained in the soil for a longer time by the plant roots acting as a sponge, tons of water vapour poured into the dry hot air by the transpiring leaves would absorb heat and tend to lower the temperature of the air by lowering the dew point to an appreciable extent, and may even improve the rainfall conditions. With more sub-soil water, with more fodder, fuel and timber, and better climatic conditions, the cultivator and the country in general would be in a far more prosperous condition than now.

The Introduction of a New Insect into Mysore.

BY

K. Kunhi Kannan, M.A., Ph.D.,

Entomologist.

There have been for several years past serious complaints against the spread of cactus into cultivated fields, areas surrounding villages and date groves. These complaints have been loudest from Nanjangud, Chamarajnagar and Gundlupet Taluks of the Mysore District and from parts of Chitaldrug and Kolar Districts. As early as 1909—10 the Government of His Highness the Maharaja of Mysore issued orders under which the Forest Department was held responsible with respect to lands under its control, for the clearance gradually of prickly pear "whenever it has extended itself to the prejudice of more useful growth" and for taking measures to prevent the spread of the weed to adjoining areas under private ownership. To encourage people to take up other lands whose assessment is below a definite limit and which are already infested with the pest, the order provided that such lands of this description as may be conveniently released may be given to cultivators free of assessment for 12 years. On lands already under cultivation but infested, remission was to be given for a period of five years. To clear prickly pear from village commons, District Board Funds were allowed to be spent. The Government

Order also made compulsory the destruction of weeds including prickly pear where they grew so far as to produce insanitary conditions in villages the cost of such destruction being recoverable as arrears of land revenue.

From this brief summary it will be seen how serious the pest has become in the State and how far the Government was alive to the necessity of bringing it under control. The measures recommended, however, were found of little avail and cactus flourishes in the parts of the State mentioned just as much now as before, although attempts to clear have been made from time to time by Revenue and Forest Officers.

The prickly pear problem is by no means confined to Mysore. It is much more serious in certain districts of Southern India especially towards Trichinopoly. Outside India, in Australia no less than 10 million acres are over-grown with various species of cactus. The situation in the island continent is graver because the farms have extensive acreage and labour is by no means so abundant or cheap as in India. The Australian authorities felt the problem so far beyond control by human agency that a Commission was appointed known as the Prickly Pear Commission to tour round the world in search of insects which when introduced would bring cactus under control. This Commission toured through several countries in America, India and Ceylon and made a selection of insects of which several have since been found useful and some are being multiplied in nurseries and distributed all over the prickly pear infested areas.

Although the removal of the weed is far from complete, the success so far achieved is so considerable that one is tempted to profit by the experience gained there. It may at first sight seem that the insect has only to be brought over to the State for it to repeat its performance. The problem is not so easy however. There are several species of cactus in Australia and there are more than one species of insects introduced there. The success so far attained in Australia is with one species of insect (*D. indicus*) against a species of cactus which is very rare in Mysore and the cactus which is so troublesome in Mysore is not so in Australia. The question then of the species both of cactus and the insect attacking them, is of the very greatest importance.

We have therefore to go into the question of the Indian species of cactus. Cactus was first introduced into India by the Portuguese who obtained the plants from Mexico—their original home. The importance of cactus lay in the fact that on it throve the cochineal insect which yielded the valuable dye known as cochineal. Several species were introduced of which *O. monacantha* in the latter half of the 18th century was the most widespread. About 1786 the rearing of cochineal insect was urged by Dr. J. Anderson on the East India Company and the actual introduction was made 9 years later by Captain Neilson who brought over a consignment of the insects to Calcutta from Rio de Janeiro. There were several other importations made later but none of these appear to have been a success.

Of the species introduced into Calcutta, specimens were sent to Madras, and from Madras to several districts under special orders of the East India Company which provided for special concessions in the matter of land revenue. Unfortunately the variety of cochineal introduced was not the right kind called *Grana fina* but *Grana Sylvestre*, which had but a fourth of the colouring properties of the superior variety and even though under the special stimulus to cultivation given by the Company large quantities were exported in 1797 and 1798, the figures gradually fell off during later years.

This variety was very destructive to cactus but only to one species of the three or four species existing in India, *viz.*, *O. monacantha*. There are plenty of records in the archives of the Government of Madras to show that the insect wiped out *O. monacantha* in several localities in the Presidency and after having killed out the host plants, died. But what is of interest in Mysore is an account given by Wilks in his historical sketches in which he refers to the former existence at Poongur on the banks of the Cauvery of fences, etc., composed of the straight-thorned opuntia (*O. monacantha*) sufficiently grown so as to cause entanglement of Tippu Sultan's horse there in September 1789 but that afterwards when its removal was contemplated, it was found that "the *sylvestre* cochineal introduced into Coromandel shortly after the order had been given, had devoured not only the leaves but the root of the plant with such avidity as nearly to have terminated its existence in the South-Eastern Provinces." Dr. Buchanan writing later in 1807 in the course of his account

of his travels, says that "Young insects of the cochineal will have in six months increased so that they may begin to be collected and that after a year or more has elapsed the whole plants are also consumed and further that as soon as the plants are consumed such of the insects as have not been collected will perish."

The destruction of prickly pear (*O. monacantha*) by the wild cochineal was subsequently noticed by several officers in Southern India, among them Mr. Balfour at Vizagapatam, and Thurston in the districts of Kurnool, Ganjam and Ananthapur. In Mysore as recently as last year a hedge of prickly pear again of the same species was noticed to have been killed by the insect.

It may therefore be reasonably held that *O. monacantha* which at one time had so spread over India as to be looked upon as an indigenous plant has been all but eradicated by the insect. Its place however in several parts of Mysore State and the Madras Presidency has been taken by *O. dillenii* but the difference in species was not apparently noticed by the Collectors of Districts and other officers who basing their conclusions on instances of the insect killing out cactus which came to their notice thought that the species which infested the districts in their charge could be similarly dealt with. But a detailed investigation carried out by Mr. Thurston in 1896 showed that "No parasites, animal or vegetable, have been observed living on prickly pear in such a manner as to warrant the hope that they might be used as an agency for the destruction of the plants."

It is obvious that reference here is to *O. dillenii* which is now the common cactus and which replaced *O. monacantha* long ago. Although the wild cochineal is of little avail in India, it was welcome in Australia where *O. monacantha* flourishes in several parts of the country. As was to be expected it has been destroying the particular cactus concerned on a vast scale.

It remained then for India to find a similar insect if possible which would deal as effectively as the Indian cochineal dealt with *O. dillenii*. That meant a Commission travelling all over the world in quest of the suitable insect or insects. Fortunately this expense, delay and trouble has been, as is hoped, saved for us by the work of the Australian Prickly Pear Commission who in the course of their investigations found an insect which, while not of any very great use

to them, appeared to them would be destructive to *O. dillenii*. Of this species specimens were forwarded to the Ceylon Entomologist in return for the help received by them in Ceylon while the Commission halted on the Island. These specimens were introduced in *O. dillenii* which is as serious a pest in Ceylon as it is in India and has been fairly destructive of the varieties in the two places they were introduced. It is too early to say whether the insect would materially assist in the eradication of the pest on the island. It has however been thought advisable to obtain consignments for Mysore and through the very kind co-operation of Dr. Hutson, Entomologist to the Ceylon Department of Agriculture, specimens have been obtained which are now thriving on cactus grown in pots in the laboratories of the Department of Agriculture. It is too early to draw any conclusions from the behaviour of the insect in Mysore. It is possible that suitable modifications may have to be made in the culture and spread of the insect in the State and it will be some time before the first consignment can be sent out into the districts. If one may judge from the behaviour of the insect in Ceylon and elsewhere however the prospects of the insect materially assisting in the eradication of cactus in Mysore may be considered bright.

Our Coffee Experiment Station.

BY

Leslie C. Coleman, m.a., ph.d.,

Director of Agriculture in Mysore.

The improvement of a perennial crop such as coffee is a much more difficult and lengthy problem than is that of an annual crop such as ragi. In the latter case if the experiments are well planned one should obtain valuable results within five or six years. For coffee at least double that time will be required. This makes it imperative that an experimental policy once laid down should be continued without interruption or alteration for a long series of years.

The Government of Mysore have fully realized the importance of continuity in experiments on coffee and have therefore recently approved of a twenty years' programme. Readers of the Journal may be interested in this programme as it will enable them to see

just what work is to be taken up in the Coffee Station and how this work is to be carried out. The programme of work is therefore appended.

PROGRAMME OF WORK FOR THE COFFEE EXPERIMENT STATION, BALEHONNUR.

Main Projects.—

The main projects on the Farm may be outlined under the following heads :—

(*a*) *Chemical :*—A study of the manurial requirements of coffee.

(*b*) *Botanical :*—An attempt to improve coffee in vigour, quality and disease-resistance through selection and hybridization.

(*c*) *Mycological :*—A study of the diseases of coffee, the chief of which are leaf disease, black-rot, die-back and root rot with the object of bringing them under control.

(*d*) *Entomological :*—A study of the insect pests of coffee—the chief of which are green bug and coffee borer.

Requirements of Land :—

(*a*) *Chemical :*—For the purpose of carrying on manurial experiments it is necessary to use coffee of as uniform a character as possible. The growing area handed over by Mr. Crawford fulfils this requirement to as great a degree as almost any area I have seen. Of this area only the most uniform inner portion has been laid out in plots for the testing of different manurial treatments. The area devoted to this purpose is about 12 acres. The balance of the area not being very suitable for manurial experiments will be used for experiments on leaf disease and die-back, the two diseases which are to a certain extent prevalent on this particular piece. This manurial area should be reserved for the purpose for at least fifteen years by which time we may have another area planted up and brought to maturity which can be used for the purpose.

(*b*) *Botanical :*—The work on breeding for vigour, quality and disease-resistance should form the main work of the Farm and should on no account be jeopardized by, or sacrificed to, anything else. Breeding of a perennial crop such as coffee will require, I estimate, at least ten years to give the first practical results and will probably require twice that period to give results of the greatest value. This necessitates that the plan of operations must be most carefully

considered beforehand and once fixed must be adhered to rigidly and carried out with the greatest perseverance. A changing policy would jeopardize the work and lead to a deplorable waste of time and money.

Breeding work will involve the growth of many thousands of individual plants under as nearly uniform conditions as possible. This work will necessitate close and continuous observation on the part of the staff. The breeding plots should, therefore, be large and as near to the buildings as the requirements of soil will permit. I propose to reserve ten acres of the best part of Mr. Crawford's jungle and fifteen acres of the Government jungle for this purpose. These areas are about a hundred yards from the laboratory site.

In addition to the 25 acres reserved for breeding work, an area of about one hundred acres should be reserved for the multiplication of our improved varieties and the production of seed for distribution. To prevent cross fertilization of these varieties it will be necessary to have the multiplication plots surrounded by belts of jungle. These multiplication plots will not come into use probably for ten or fifteen years as it will take that long to develop our first selections to the point where we are able to multiply them.

In addition to this definite breeding work, investigations of the possibility of growing high quality Arabica coffee on vigorous root stocks such as Robusta by grafting should be taken up immediately. This will demand the remainder of the area in Mr. Crawford's jungle, roughly 7 acres.

(c) *Mycological Investigations* :—As already noted the main diseases at present to be found on coffee in South India are leaf disease, black-rot, die-back and root or stump rot. The investigation of these diseases can be undertaken partly on the area of growing coffee handed over by Mr. Crawford. However, black-rot and stump rot are not serious on the plot nor are they likely to be in the near future. Arrangements will be made immediately with planters in the neighbourhood and farther afield for the provision of facilities for field study. Mr. Crawford's large holdings in the neighbourhood should furnish us with all the material we require for the purpose within a radius of a few miles. The chief additional requirements in this connection are laboratory facilities for investigation on the spot and these will be provided as fully as possible.

In addition to the above we have the investigation of the value of various fungicides and of the efficiency of the various types of spray machinery. I have already had assurances from Mr. Frend, Mr. Crawford's Manager, that he will provide us with facilities in this regard.

I may note that practical results are likely to accrue from this type of work much sooner than from our breeding work but the final results from it are not likely to be so important.

(*d*) *Entomological* :—As in the case of Mycological work, facilities for field work on the insect pests of coffee will have to be sought largely on private estates in the coffee area. The station will furnish us with the essential laboratory and insectary facilities and will serve as a centre for the work.

Other Coffee Problems :—There are of course a large number of problems connected with coffee cultivation which are not covered by the above programme. Among these may be mentioned problems of cultivation and of shade. These problems are, I consider, not of such pressing importance as to warrant our locking up comparatively large blocks of land for the purpose and so interfering with the more important breeding work which should remain the main object of the station's activities. There is always a danger of taking up more problems than the staff of the station can handle and our facilities will warrant. We must guard most carefully against this danger.

Subsidiary Lines of Work.—While the station should remain mainly a Coffee Experiment Station, it should be utilized for the study of other planters' crops as well. Among these may be mentioned cardamoms, pepper and tea, all crops either of present or potential importance to the State. The natural facilities for the study of cardamom cultivation and varieties are, I consider, particularly good and as this important crop has heretofore received practically no scientific attention we have a large and useful field before us. I propose starting on a study of cardamom varieties with the object of obtaining material for breeding work. A study of cardamom pests and diseases as also of cardamom manuring will be taken up as occasion permits. Somewhat similar work will be undertaken on pepper, while in connection with tea the only problem I should propose taking up in the near future is a study of root

rot, a disease either closely related to or identical with the root rot of coffee. I may point out that starting work on these will not involve the utilization of any land at all suitable for coffee experiments.

An examination of this memorandum will show that it will be necessary to reserve about 150 acres for experimental work which will be brought into cultivation in from 15 to 20 years. In the next few years an annual planting of from 5 to 10 acres is all we should undertake as we must reserve our jungle for the planting of our selected varieties. It would, I consider, be a most serious breach of trust if we were to attempt to make the station even to a moderate degree self-supporting by sacrificing the real functions of the station to the clamour for revenue. The planting up of large areas of jungle now would simply make it impossible to carry on the real programme of the Farm, for when we came to the stage when we wanted to multiply our selections we should either have no land on which to grow them or would have to uproot coffee of, say, ten or fifteen years' standing. Even then the land would probably be very seriously reduced in value from a coffee growing standpoint.

The following is a summary of the important points in this memorandum :—

1. This station must be used as an experiment station and not for the purpose of attempting to grow a large acreage of coffee at a profit.

2. Coffee breeding should be the chief item of work on the station and about 125 acres should be set apart for the actual breeding work and the multiplication of seed from selected varieties once they are secured. It is unlikely the whole of this land will be brought under cultivation within a period of less than twenty years.

3. Work on the manurial requirements of coffee has already commenced and should form the main item of work on the area of coffee handed over by Mr. Crawford probably for the next ten or fifteen years. As areas are planted up to our selections, these will become available for further manurial experiments and for such other experiments as those on cultivation, influence of shade, etc.

4. The work on the diseases of coffee will be centred in the station. Field work in this connection will be carried on as far as

possible in the station but will have to be extended to estates and areas where the particular diseases are most prevalent. This applies especially to the study of control measures.

5. Work on the insect pests of coffee will have to be conducted in much the same manner as that on diseases.

6. In addition to the investigation of coffee problems, those concerning other planters' crops such as cardamoms, pepper and tea should be taken up on the station *only when staff and funds permit.* They should in no way be allowed to interfere with the real functions of the station as one for the study of coffee problems.

Improvement of the Coffee Industry in Mysore.

BY

B. Narasimha Iyengar, b.a., ph.d.,

Agricultural Chemist.

For some years past, many planters have been complaining that their industry is not in a flourishing state and are asking for measures to improve it. The establishment of the Coffee Experimental Station at Balehonnur has made it incumbent on the Department of Agriculture to make an intensive study of the industry and find out means of improving the same.

A tour through the Coffee Districts of Mysore and a discussion with a few Planters gave me the impression that estates of European Planters were generally in a better condition and also paid better than those of Indian Planters. Generally speaking, European Planters seem to spend more money than Indian Planters on manuring. Of course, there are a few estates owned and managed by Indians which are in good condition.

A good average yield from a well-managed estate seems to be about 5 cwts. or 20 maunds of clean coffee per acre. To get an idea of the changes in yield due to season, unsatisfactory manuring, etc., an attempt was made to get statistics from a few estates of Indian Planters. But the attempt was not very successful as most of the owners said that they do not maintain such accounts. However, whatever data could be obtained is given below :—

Estate A :—60 *acres in extent and situated on the Bababudans.*

Year	Total Yield in Maunds	Yield per acre in Maunds
1890—91	31	0.50
1891—92	230	3.80
1892—93	156	2.50
1893—94	450	7.50
1894—95	303	5.00
1895—96	585	9.75
1896—97	170	2.80
1897—98	55	1.00
1898—99	750	12.50
1899—1900	205	3.40
1900—01	780	13.00
1901—02	212	3.50
1902—03	1,025	17.08
1903—04	210	3.50
1904—05	773	12.90
1905—06	958	16.00
1906—07	635	10.50
1907—08	1,200	20.00
1908—09	600	10.00
1909—10	1,768	29.50
Average per year for the whole period		9.25

Statistics of this estate are not available from 1910 up to 1923. Taking the whole period from 1890 to 1910, *i.e.*, 20 years, the estate has given an average annual yield of 9.25 maunds per acre.

During the above period, not much money has been spent on manuring. Now and then, a mixture of groundnut and honge oil-cakes had been used in small quantities and occasionally some manure mixtures from Messrs. Parry & Co., or Pierce Leslie & Co., were applied.

Then followed a period of neglect of this area of 60 acres and a new block of 37 acres in all was opened during the course of the next few years. By the year 1923, the whole estate consisted of about 97 acres and the crop statistics available are as follows :—

Year	Total Yield in Maunds	Yield per acre in Maunds
1923—24	1,310	13.5
1924—25	490	5.0
1925—26	360	3.7
1926—27	950	9.8

From these figures, it is seen that the best yield per acre fell from 29.5 maunds in 1909—10 to 13.5 maunds in 1923—24 and further to 9.8 maunds in 1926—27.

Another estate for which statistics are available is 95 acres in extent and is situated in the Belur-Mudigere area, and the yields are as follows :—

Year	Total Yield in Maunds	Yield per acre in Maunds
1917—18	880	9.0
1918—19	720	7.5
1919—20	1,920	20.0
1920—21	640	7.0
1921—22	1,600	17.0
1922—23	1,280	13.5
1923—24	960	10.0
1924—25	960	10.0
1925—26	520	5.5
1926—27	1,600	17.0
Average per year for the whole period		11.6

This estate has not suffered so much neglect as the previous one and is also in a much better condition.

Even with regard to manures, about 15 to 20 tons of some manure or other has been used almost every year.

For the sake of comparison, the yields from an estate of 165 acres in Coorg are given below :—

Year	Total Yield in Maunds	Yield per acre in Maunds
1916—17	2,562	15.50
1917—18	569	3.45
1918—19	3,096	19.00
1919—20	1,074	6.15
1920—21	2,180	13.20
1921—22	1,111	6.70
1922—23	3,938	24.40
1923—24	422	2.50
1924—25	3,622	22.00
1925—26	616	3.70
Average per year for the whole period		17.50

Just by the side of the above estate is another small estate of 37 acres and the yields are as follows :—

Year	Total Yield in Maunds	Yield per acre in Maunds
1916—17	1,540	41.6
1917—18	214	6.0
1918—19	1,262	34.1
1919—20	279	7.5
1920—21	509	14.0
1921—22	597	16.0
1922—23	581	15.6
1923—24	213	6.0
1924—25	827	22.4
1925—26	208	5.6
Average per year for the whole period		17.0

The above two estates also have received some manure almost every year. The maximum amount of manure put in has been at the rate of 1 ton of manure, consisting mostly of oil-cakes, fish and bone, for every ton of coffee produced. Since the rate of manuring was not maintained every year, it might be said that these estates also have suffered a certain amount of neglect in that direction.

A complete set of statistics available for an estate of 120 acres situated on the Bababudans at an altitude of 3,500—3,800 feet is given below :—

Year	Total Yield in Maunds	Yield per acre in Maunds	Manure applied
1908—09	418	3.48	Nil.
1909—10	1,300	10.83	10 tons Poonac and Bone-meal 2 : 1.
1910—11	?	?	Whole fish 7 tons.
1911—12	1,328	11.07	Nil.
1912—13	992	8.26	7 tons lime.
1913—14	667	5.55	20 tons Poonac and Bone-meal 2 : 1.
1914—15	620	5.16	7 tons lime.
1915—16	780	6.5	7 tons lime.
1916—17	1,021	8.5	7 tons Parry's Fertilizer No. 1.
1917—18	1,021	8.5	14 tons fish guano.
1918—19	2,136	17.8	20 tons Poonac and Bone-meal 2 : 1.
1919—20	403	3.35	15 tons Poonac and Bone-meal 2 : 1.
1920—21	1,124	9.36	8 tons fish guano.
1921—22	681	5.67	Nil.
1922—23	554	4.61	Nil.
1923—24	768	6.40	20 tons Bone-meal and Poonac 1 : 2.
1924—25	882	7.35	4 tons Bone-meal.
1925—26	570	4.75	7½ tons lime.
1926—27	1,184	9.86	20 tons Poonac, Bone-meal and Muriate of Potash.
1927—28	1,010	8.41	20 tons Parry's Coffee Fertilizer No. 1.

Average per year for the whole period 7.60.

Even on this estate which has been manured every year, the yield has not been satisfactory. The quantity of manure applied has been insufficient and wanting in Potash as well generally.

From the statistics given above, it is seen that the maximum yield per acre varies from 17 maunds (*per acre*) to 41.6 maunds (*per acre*) indicating what scope there is for improvement in production.

The main reason that a good many planters advance for the decay of the industry as judged by their own estates is the fitfulness of the blossom showers. From enquiries made in the Mysore State as well as in Coorg, I am rather disinclined to believe in the failure of the blossom showers. What has come out of my enquiries is that in a well-maintained estate, a blossom shower of 30 to 50 cents of rain is quite enough whereas in neglected estates situated side by side, a shower of even over 50 cents is not entirely satisfactory.

Another cause advanced for the decay of the industry is the appearance of insect pests and fungoid diseases. It seems to me that this is the case mostly in neglected estates which become a menace and source of infection to the adjoining well-kept estates as well. As this is beyond my sphere of work, I leave it to be dealt with by my colleagues in the Department.

Increased yield of any crop can be brought about by introducing improved variety of seed, improved methods of cultivation and improved methods of manuring. Of the improvement that can be brought about by a combination of the above-mentioned three factors, it has been estimated in Europe and America that 50 per cent of the improvement is due to manuring, 30% due to improved seed and 20% to improved methods of cultivation.

In the case of a crop like coffee, the question of improved variety of seed does not, at present at any rate, arise. As long as the existing plants are there, our main business is to try to increase the yield from them. The methods of cultivation in vogue in coffee estates have been dealt with fairly extensively by Mr. R. D. Anstead in his bulletin on "Coffee Cultivation" issued by the Department of Agriculture, Mysore State.

It only remains for me to go in detail into the question of manuring coffee. European Planters do no doubt make use of a lot of artificial manures, but the majority of them seem to buy ready made mixtures put on the market by firms like Messrs. Parry & Co., Pierce Leslie & Co., and Stanes & Co., etc. These firms do no doubt guarantee the percentage of nitrogen, phosphoric acid and potash in the mixtures, but do not generally say anything about their availability. Among the planters that make their own mixtures of

manures, a mixture of oil-cake, bone-meal and muriate of potash seems to be very popular.

Analysis of the coffee bean made in this laboratory during the time of Dr. Lehmann between the years 1905—07 and published on page 48 of the Annual Report of the Agricultural Chemist for 1907—08 shows that the average composition of the coffee bean from Mysore and Coorg is as follows :—

Nitrogen ..	.. 2.3%
Phosphoric acid ..	.. 0.4%
Potash	.. 2.0%

I have heard from planters, European as well as Indian, that a bumper crop of coffee may yield up to 1,200 lbs. of clean coffee per acre. In such a case the amount of plant foods per acre removed by the marketable product alone works out to—

Nitrogen ..	.. 27 lbs.
Phosphoric acid ..	.. 5 lbs.
Potash	.. 24 lbs.

According to the experience of Agricultural Chemists in Germany, there are certain factors affecting the utilization of manures applied. Only 60% of the available nitrogen, 10% of the soluble phosphoric acid and 50% of potash applied seem to be used up by a crop. Hence it is clear that due allowance must be made for this fact when applying manures for any crop, and larger quantities of plant foods must be applied as manure than what are removed by a crop.

Hence, to make good the loss as detailed above, we have to apply about—

45 lbs. of Nitrogen,
50 lbs. of Phosphoric acid
and 48 lbs. of Potash
in the form of soluble manure.

To this has to be added what is lost in the pulp and what is utilized by shade trees. I have neglected the plant foods used up by weeds, for they are put back into the soil when the weeds are pulled out and allowed to decay on the spot. Only a part of the

plant foods taken up by shade trees is returned to the soil in the form of leaves that drop down to decay.

When nitrogenous and phosphatic manures are applied together, they seem to act best in Germany where the ratio of nitrogen to phosphoric acid is about 1 : 3, but for some crops in Mysore, a ratio of 2 : 3 has been found to be very advantageous. So, we may not be far wrong when we supply in the manures added—

50 lbs. of Nitrogen,
75 lbs. of Phosphoric acid,
and 100 lbs. of Potash, per acre.

This ratio of 2 : 3 : 4 with regard to nitrogen, phosphoric acid and potash has been found to be very advantageous for coffee in Brazil and a supply of 50 lbs. of nitrogen, 75 lbs. of phosphoric acid and 100 lbs. of potash per acre is also advocated. From the calculations given above, it is seen that the practice followed in Brazil is not at all unreasonable even with regard to the ratio of plant foods which a standard manure mixture for coffee ought to contain.

In the absence of data suited to local conditions, the ratio of 2 : 3 : 4 found advantageous in Brazil has been taken as the basis for work on the Balehonnur Coffee Experimental Station and suitable modifications will be introduced in due course to find out if the ratio requires any modification at all. It may also be mentioned here that the same ratio was introduced on the Siddapur Coffee Experimental Station also just before it was decided to close it down.

It may be contended as to why manures should be applied based on the requirements of a bumper crop of 1,200 lbs. per acre or 1 lb. per tree planted 6 feet apart. Since the coffee bush has got to fulfil two functions simultaneously that of maturing a crop and putting forth fresh wood for a succeeding crop, it is always safe to provide for requirements of a maximum crop. Otherwise, in the year succeeding a bumper crop, there will naturally be a very poor crop. It is only when such an application is found to be unprofitable that we are justified in reducing the dose of manure to the most profitable limit.

It is the opinion of experienced planters that a well-maintained estate yields on an average about 20 maunds or in round figures

600 lbs. of coffee per acre. To cater for the needs of such a crop based on the calculations given above, we have got to supply in the form of a good manure mixture about 25 lbs. of nitrogen, 37.5 lbs. of phosphoric acid and 50 lbs. of potash per acre. It has also been my local experience with other crops that any quantity less than 20 lbs. of nitrogen per acre does not show its effect properly on a crop. To be just moderate, I would suggest for coffee, for the present, an application of 30 lbs. of nitrogen, 45 lbs. of phosphoric acid and 60 lbs. of potash per acre.

A mixture consisting of about—

400 lbs. of groundnut cake,

100 lbs. of concentrated superphosphate,

and 120 lbs. of sulphate of potash

would supply the needs of an acre of coffee and works out to about 8 ozs. per plant planted 6 feet apart.

During one of my tours through parts of the coffee districts of Mysore, some planters told me that they do apply as much as 12 ozs. of a good manure mixture per plant, and that small doses of 4 to 6 ozs. constituted a mere waste of money. As a rule, most planters do not want to spend more than Rs. 30 an acre on manures. With the increase in the distance of transport to the estates the cost of manure also increases and consequently the quantity of manure per acre decreases, if the thirty-rupee limit is strictly adhered to. Manuring must be considered from a business point of view and the cost adjusted accordingly. Sometimes, ability to finance may be a serious obstacle in the way of adequately manuring an estate. Generally, as old estates begin to yield less and less, they are more and more neglected and new clearings opened out. Instead of spending money on new clearings and neglecting old estates, it would be a wise policy to spend that money on the manuring of old estates and get increased yields from them alone, specially where labour is scarce and hard to secure as well.

Let me now go to a discussion of the materials available for making up good manure mixtures for coffee. So far as potash is concerned, sulphate of potash and muriate of potash are the only ones suited to our purpose. For the supply of phosphoric acid, steamed bone and concentrated superphosphate may be made use of. So far as sources

of nitrogen are concerned, I would give the first place to oil-cakes, specially groundnut and castor, which decompose soon and become available to plants, and which are local products as well. The following may be considered as a few typical mixtures for trial:—

1.	Groundnut cake	400 lbs.
	Concentrated Super	100 lbs.
	Sulphate of Potash	120 lbs.
		620 lbs.

applied at the rate of 1 ton for 3.5 acres.

2.	Castor cake	700 lbs.
	Steamed bone-meal	200 lbs.
	Muriate of Potash	120 lbs.
		1,020 lbs.

applied at the rate of 1 ton for 2.2 acres.

3.	Groundnut cake	300 lbs.
	Castor cake	200 lbs.
	Concentrated Super	100 lbs.
	Sulphate of Potash	120 lbs.
		720 lbs.

applied at the rate of 1 ton for 3 acres.

4.	Groundnut cake	300 lbs.
	Castor cake	150 lbs.
	Concentrated Super	75 lbs.
	Steamed bone	75 lbs.
	Sulphate of Potash	60 lbs.
	Muriate of Potash	60 lbs.
		720 lbs.

applied at the rate of 1 ton for 3 acres.

With the materials available, many more such combinations may be made and a few such combinations may be tried on private estates.

Besides oil-cakes, there are other sources of nitrogen as well. They are Sulphate of Ammonia, Nitrate of Soda, Calcium Cyanamide and Floranid.

Since it is not advisable to make up the mixtures out of purely mineral manures, I would give preference to oil-cakes as sources of nitrogen. To bring up "Supply" plants quickly and vigorously, sulphate of ammonia may be used as the source of nitrogen in the early stages at least of the plant. Nitrate of soda is no doubt a very quick-acting manure and has given good results in the well-drained soils of Europe. At the same time, people in some parts of America have had a bad experience of it on soils rich in iron. Most of our soils being rich in iron and ill-drained, a certain amount of care is necessary in using nitrate of soda. Moreover, the soda in it may hasten alkali formation on lands not properly drained and already inclined to be saline.

On soils deficient in lime, as the laterite red soils usually are, calcium cyanamide may be tried, for, in addition to nitrogen, it supplies a certain amount of lime as well.

"Floranid" is a new manure put upon the market by Germany. It is pure urea and contains about 42-44 per cent nitrogen. It has no injurious action on the soil and may prove a serious competitor in places to which manures have to be transported from great distances, as its concentrated nature brings about a saving in freight charges.

It may not be out of place here to say a few words about the lime requirements of coffee soils.

During the last few years, a lot of attention is being devoted in Europe and America to the question of acidity and lime requirements of soils. Most of the accurate tests are tedious and require costly apparatus and technical skill as well. Recently, the British Drug Houses Limited, London, have put upon the market a simple soil testing outfit designed for the use of British Farmers. I have made use of this equipment in testing soil samples from over 1,200 acres of coffee estates and found that it gives a sort of rough indication of the lime requirements. The tests so made have been correlated with liming of the soil as well, and found to be satisfactory. Of course the test does not say anything about the actual amount of lime required but only indicates the degree of acidity of the soil in a rough sort of way.

Most of our coffee estates are over 50 years old and may require lime to correct the soil acidity. A good many planters are now applying either shell lime or burnt lime. Both these are usually air-slaked and then applied. It is not advisable to apply caustic or quick lime to ordinary soils for it decomposes the humus rapidly. Quick-lime may prove beneficial on very heavy clay soils in improving its texture.

Recently in England, the application of lime to soils is being done and Government Agency supplies ground limestone to the farmers at a certain rate and the money is recovered in instalments spread over a number of years. Since application of lime need be done only once in 10 or 12 years, it may be worth while considering the supply of ground limestone or kankar to planters through the Geological Department. The finely ground material delivered in definite planting centres ought not to cost more than Rs. 30 a ton. With the introduction of potash manures, it becomes all the more necessary to lime periodically. Even if it is applied at the rate of one ton per acre every ten years, the coffee estates alone will be able to take up about 10,000 tons a year on an average.

Simultaneously with the opening of the Coffee Station in 1925, I was asked by some of my friends in Coorg to inspect their estates and suggest improved methods of manuring. The area consists of four groups of estates in different parts of Coorg and is about 1,300 acres in extent. Making use of the results of Brazil and of my own experiments on the availability of manures under our conditions of soil and climate, I suggested certain manure mixtures for trial on small areas in each group of estates. But the parties decided to try the manures on the whole area at once and started the campaign in April 1926. Previous to that, they had applied only oil-cakes or oil-cakes and bone-meal. But neither of these had been applied in sufficient quantities. At the same time, they started applying lime also as indicated by the B. D. H. soil testing outfit. The data available for the various groups of estates from 1921—22 up to 1926—27 shows the improvement brought about. It is only the partial effects of the manure mixtures that is seen in the crop of 1926—27. The full effect will be seen in those of the years 1927—1928 and 1928—29. The estimated crop for 1927—28 that is now being picked is 500 candies of 20 maunds each, whereas in the corresponding lean year of

1925—26, it was only 322 candies. The yields given in the annexed table give an idea of the improvement brought about during a short period of 5 years through cakes, cakes and bone, and through the application of a balanced manure mixture in addition to cultural operations.

It may be of interest to note that the working cost including establishment as well, is between Rs. 100 to Rs. 120 an acre and the cost of manuring alone is Rs. 30 an acre. Encouraged by the results obtained till now, the parties have consented to try heavier manuring costing Rs. 50 an acre on about 330 acres this year.

TABLE SHOWING IMPROVEMENT IN YIELD OF COFFEE IN NEGLECTED ESTATES CONTAINING PLANTS 30 TO 60 YEARS OLD.

Estate Group	Acres	1921—22	1922—23	1923—24	1924—25	1925—26	1926—27
		Cds. Mds. lbs.	Cds. Mds. lbs.	Cds. Mds. lbs.	Cds. Mds. lbs.	Cds. Mds. lbs.	Cds. Mds. lbs.
A	335	67 19 0	118 14 25¼	69 0 0	256 18 4	57 1 10	284 18 2
B	422	95 0 2	331 3 1½	128 2 6	433 7 23	131 2 6	471 4 10
C	322	53 18 26	214 12 16	84 8 27	289 5 4	73 5 23	326 1 4
D	225	42 17 25	156 12 15	67 17 8	200 15 15	60 8 0	291 2 7
Total ..	1,304	259 15 25	821 2 19¾	349 8 13	1,180 4 18	321 17 11	1,373 5 23
			Yield per Acre in Maunds of 28 lbs. each.				
A		4.0	7.0	4.0	15.3	3.4	17.0
B		4.5	15.7	6.0	20.5	6.2	22.3
C		3.3	13.3	5.2	18.0	4.5	20.2
D		3.8	14.0	6.0	18.0	5.3	26.0
Total average ..		4.0	12.6	5.4	18.0	5.0	21.0

N.B.—Only oil-cakes, bone and fish guano were used from 1921 September to 1926 April.

Part of the area was limed in April, 1926 and manured with a balanced mixture containing potash as well in September 1926, April 1927 and September 1927.

Remaining part was given manure mixture in April and September 1926, limed in March 1927 and manured again in September 1927. Cost of manure per acre is Rs. 30.

Before potash manuring was introduced, it is said that the blossom required about 50 cents of rain for proper setting whereas after manuring with potash, only 20 to 30 cents seem to have been sufficient.

In addition to continuing the balanced manure containing nitrogen, phosphoric acid and potash in certain proportions, new experiments with extra dose of manure to try to reduce the gap between bumper and lean crops have been started this year on 330 acres in blocks of 30 to 50 acres each and arrangements made for harvesting these blocks separately.

SELECTIONS.

Seed Trials in the Laboratory and the Field.

"Good *versus* Bad Seed" has represented the title of many published papers and been the theme of centuries of discussion. What applies in seed trays and careful sowings may not, and often does not, apply to wet, cold, lumpy tilths. There appears to be a need for further study of the influence of the seed on the crop under farming conditions, and for a link between germination capacity in a laboratory test and value in the field. While waiting for further knowledge, the old rule "do not economise on seed" is the safest guide.—*Agricultural Gazette of N. S. W.*, Vol. XXXIX, Part 2.

The Scope of Agricultural Research.

Popular conceptions of research are sometimes apt to be rigidly linked to pictures of painstaking work with test tubes, microscopes, caged animals, and a variety of other indoor objects. But research in the applied sciences, though often originating in small-scale studies, must have the freedom of flocks and herds, of fields, and even countrysides. It must attend, moreover, to practical farming needs and to considerations of profit and loss. In consequence there arises, in connection with agricultural science, a wide and important, more or less routine, branch of activities. To this is entrusted the practical utilization of what pure and applied science teaches as well as the task of helping to find out in what matters industry particularly needs the help of science.—*Agricultural Gazette of N. S. W.*, Vol. XXXIX, Part 2.

Sugar and Alcohol from Cellulose.

Wood, Straw, Sisal Waste and Bagasse as Raw Materials.

A report has been received by the Power Alcohol Section of the British Empire Producers' Organization, of the first tests carried out in a factory in Germany on a commercial scale for using sawdust, straw, sisal waste and bagasse as raw materials for the production of grape sugar and ethyl alcohol.

The process consists of the saturation by hydrochloric gas, in the presence of catalysts, of the raw materials, and in a period of under one hour the whole of the cellulose content is converted into glucose. This glucose is then treated for the removal of the acid, and can either be sold as cattle food, or refined as pure white glucose for human consumption, or it can be fermented into alcohol for fuel, industrial or portable purposes. As much as 60% of the weight of the dried sawdust has been obtained in pure sugar, and in the case of straws and other materials higher percentages are obtained.

The development of such process must have a far-reaching effect in the Dominions and Colonies where large supplies of raw materials of the kind mentioned are now being wasted, and also in those countries where abundant supplies of grasses and bamboos are available, as these materials are equally suitable for conversion into alcohol.

Various European Governments are investigating the process and the Australian Government has sent a representative. It seems probable that this process in the near future will provide countries with an alternate motor fuel supply to that of petrol.—*Tropical Agriculturist*, Vol. LXX, No. 2.

Farmers' Co-operative Experiments with Field Crops.

In the spring of 1886 the writer distributed seed and fertilizers to twelve farmers throughout Ontario, who agreed to conduct the tests on their own farms in accordance with instructions furnished by the college through the medium of the Experimental Union. That was the beginning of the present system of co-operative experiments which has been conducted throughout Ontario continuously for forty-one years. There are now forty-six distinct and separate co-operative experiments conducted over Ontario each year. In the forty-one year period no less than 107,633 of these co-operative experiments have been conducted on individual farms. This means an average of 2,691 co-operative experiments conducted annually. During the later part of the war, and immediately afterwards the work dropped considerably. It has, however, steadily increased from 1,616 co-operative experiments in 1921 to 3,277 in 1926.

This shows that even in the past year the average number of co-operative experiments was surpassed by no less than 586. These co-operative experiments which are conducted from the college through the medium of the Ontario Agricultural and Experimental Union are still occupying an important place in progressive crop production of the province.

It is impossible to estimate the great good which has been brought about in various ways through the medium of the co-operative experimental work. The principal conclusions from the carefully-conducted experiments carried on throughout the province are presented and discussed each year at the annual meeting of the Experimental Union. Any interested farmers of Ontario are always welcome to this gathering. The results of the co-operative experiments and the proceedings of the annual meeting are printed in the annual report which usually fills about sixty pages and generally about 30,000 copies are issued. These annual reports may be obtained by writing to the Department of Agriculture, Parliament Buildings, Toronto.—*Ontario Department of Agriculture Bulletin No.* 332.

Continuous Growing of Varieties without Change of Seed.

Each of ten varieties of farm crops has been grown in an experimental way at our College for the forty years from 1887 to 1926 inclusive. Each of thirty-one varieties have been grown from thirty to thirty-seven years without change of seed. The results of tests conducted throughout this period will be presented in the following pages. The detailed results are very interesting and show that varieties of grain crops may be grown in Ontario for a long period of time without change of seed and with very satisfactory results if care is exercised in using seed of good quality.

It is still considered necessary by a few farmers to change seed quite frequently from one soil to another. The question of frequent change of seed has been discussed and argued for many years. There are some strong advocates for a frequent change of seed while other men are just as strong in advocating the continuous growing of varieties on the same farm for a number of years and especially if they have choice varieties and have been careful in the selection of seed from year to year. An increasing number of practical farmers are realizing more and more the fact that in very many cases they are able to grow the same varieties for a long time without change of seed providing proper care is taken in growing varieties suitable for the soil, in the careful selection of seed and in the cultivation of the land. In the experiments which have been conducted at Guelph within the past forty years care has been taken to have the crops grown under as normal conditions as possible. The soil on which these crops have grown has changed but little in fertility and no commercial fertilizers have been used on the land. The crops simply fitted into the four-year rotation which is considered by practical farmers to be a

more severe rotation than the one used on the College farm as in our experimental grounds in the four-year rotation two crops of grain and one cultivated crop have been removed from the land, the crop in the other year being used for the pastures. No plant selection was used in these tests but good seed was sown each year. It is sometimes wise for the practical grower to change his seed when better and more profitable varieties are obtainable. Otherwise it is often to the interest of the careful grower to change seed as seldom possible.—*Ontario Department of Agriculture Bulletin No.* 332.

Temperature and Food Requirements of Animals.

By Professor T. B. Wood.

It is commonly supposed that animals require more food in cold weather than in summer. There are, however, very few accurate measurements. Capstick and Wood have recorded a series of accurate measurements of the heat evolution of a pig when at rest and fasting and when exposed to temperature varying from 10 degrees Centigrade to 24 degrees Centigrade. It was found that the heat evolution was constant from 20°C. to 24°C. Below 20°C. it rose with falling temperature at the rate of approximately 4 per cent per degree Centigrade. Measurements were not made below 10°C., but there is no reason to think that the rate of rise would not continue below this temperature. The reaction of the fasting pig to change of temperature, therefore, changes at 20°C.

The observations were made on the fasting animal. Let us suppose that an animal is eating 5 lbs. of barley meal per day, and that his "basal metabolism," *i.e.*, the heat evolution necessary to maintain his vital process, is 2,000 calories per day. Now 1 lb. of barley meal produces in the body of the pig 1,460 calories, of which only 1,060 calories being necessarily converted into heat during the processes of digestion and absorption. There will result, therefore, from the digestion and absorption of the 5 lbs. of barley meal 2,000 calories of heat which can be used for the maintenance of body temperature, but to no other purpose. Since the basal metabolism is 2,000 calories per day, and a fall of temperature of 1°C. causes a rise in basal metabolism of 4 per cent for maintenance of body temperature, the extra demand for this purpose is 80 calories per degree C. To meet this, there are the 2,000 calories from the digestion and absorption of the food, and there will, therefore, be no need for increased oxidation, and no increase in food requirements until the temperature falls 25°C. below 20°C., *i.e.*, to −5 °C. This, of course, assumes

that all conditions, except temperature, are the same, which is not true, since the inside of the calorimeter used in the experiments is a much more sheltered position than the commercial pig usually occupies in winter.

The practical conclusion is that fall in temperature only does not directly increase food requirements in the case of full-fed animals under practical conditions. Fall or rise of temperature may do so indirectly by occasioning discomfort, which results in excessive muscular movements.—*The Journal of the Ministry of Agriculture*, Vol. 34, No. 12.

Sugar Notes.

Silk from Sugarcane.

The American Technical Sugar Press, in their report of the Forty seventh Annual Meeting of the Hawaiian Sugar Planters' Association, which started on November 16, gave prominence to a paper contributed by J. N. S. Williams, a member of the Association which dealt with the manufacture of artificial silk from bagasse dust. It was stated that from 5 to 7 per cent of the bagasse is in the form of dust and experiments had showed that more than one-third of this dust consisted of cellulose. Samples of the dust had been sent to rayon manufacturers, who showed great interest, and it was estimated that its minimum value would be around $140 per ton at 34.8 per cent cellulose content. At this value 40,000 tons of dust, which Mr. Williams estimated as being only about half of the actual supply available, would be worth $11,000,000, so the suggestion made in one of our exchanges that the value might even be increased to $22,000,000 can easily be arrived at. A motion was adopted authorizing the trustees to appropriate money for further experiments.

Synthetic Lumber from Bagasse.

Another proposed use of bagasse, writes "The Louisiana Planter", lies in its possible utilization in the manufacture of building boards and synthetic lumber. We believe that we have called attention to this before, when it was also proposed to use the bagasse as the raw material for paper making. At that time we wondered how it would pay, for was not the bagasse needed as fuel for the furnaces? If they used it all or a large portion for paper or wood-making, what would these estate factories do whose furnaces had been constructed to burn the bagasse?

In the present instance Mr. Sydney T. Carr, engineer of the Hawaiian Electric Company, pointed out that under the patents already granted,

not only could a laminated form of lumber be made at a great saving, but there was also the possibility of a profit turning out of this artificial timber by substituting fuel oil in the furnace instead of the bagasse. One finds it difficult to believe so, in face of the demand for and price of fuel oil. All the same, it is a matter which, in the first place, only affects the planters and they must check the figures and see how those which give the results claimed for them out in Hawaii, work out in connection with their own estate factories.

Optimum Results from Manured Cane Lands.

Experimental and also estate work carried out in Java, tends to show, according to published reports, that a crop of 42 tons of sugarcane per acre (variety not given) removes 76 lbs. of nitrogen, 53 lbs. of phosphate, 72 lbs. of lime and 173 lbs. of potash from the soil. Whilst excessive manuring with nitrogenous fertilizers leads to luxuriant growth, the sugar content of the cane at the same time is lowered, and the mechanical strength of the sugarcane diminished. Potash counteracts these tendencies, and should therefore always be supplied when heavy nitrogenous manuring is practised although it is generally found best to apply nitrate of soda little and often, rather than "lots" at once. Phosphate hastens ripening, and should not be omitted from a balanced fertilizer for sugarcane.

In Cuba, a manurial mixture containing a high proportion of potash proved to be the best. The same experience was gained at the Bundaberg Sugarcane Experiment Station in Queensland, Australia.

The following complete fertilizer for a (sugar) cane crop has been recommended :—

		Per acre.
1.	Nitrate of soda	300—600 lbs.
2.	Superphosphate of lime ..	300—600 ,,
	or Basic slag	300—600 ,,
	or Bone-meal	200—400 ,,
3.	Sulphate of potash	100—200 ,,

It will be well to remember, however, that this general recommendation probably applies only to sugarcane growing on poor soil possessing suitable tilth, for it is well known that different results are obtained when different soils are treated with the same manurial mixtures in different parts of the world. The main point brought out—a point which this Journal has preached since it first started, is that potash, in one form or the other, should not be left out, when manurial programmes for sugarcane cultivation are under consideration.—*Tropical Life*, 24th Year, No. 271.

Size of Seed and Seed Selection.

Good seed is at the very foundation of successful crop production. Seed selection is within the reach of every farmer. Naturally the greatest possible care must be taken but the crop grower is more than paid for his extra effort.

In order to obtain definite results on the influence of different selections of seed it is necessary to plan and carry out definite experimental work and as this is expensive it can be done best at an experiment station where equipment is suitable and trained labour is available.

An interesting and valuable experiment has been carried on at Guelph in which different selections of seed of various classes of grain have been tested from six to nine years. For this experiment seed was taken each year from a general crop of grain grown either on the College Farm or in the Experimental Department. It will be understood that whatever difference there is from the influence of the selection of seed that difference is attributed entirely to the careful selection of the seed for the separate years in which the tests were made. The results show the influence of one year's selection, and are, therefore, of special interest to the practical farmer. For the large plump seed none but the well-developed grains were selected; for the small plump sample the grains selected were of a uniform character; and for the shrunken sample none but shrunken grains were used, the last selection being made regardless of the size of the kernels. The sample of broken grain in the case of barley, and also of rye contained nothing but grains which had been broken crosswise; split grain, in the case of winter wheat, contained nothing but grains which were broken lengthwise; and split seed, in the case of peas, contained peas which were split and not broken. The grain from which these selections were made was all threshed with a grain separator, and the splitting and the breaking of the grains were, therefore, done in the usual process of threshing. In the selection of large plump seed, one-half pound was carefully weighed from each class of grain. The number of large plump seeds of each kind of grain was then counted, and a corresponding number was taken of the medium sized grain, the small plump grain and the shrunken grain. In the case of the broken or split grain, twice the number of half kernels, as compared with the whole grains, were used. The different selections were carefully sown upon plots of similar size. The following table gives the average yearly results of each selection made from six different classes of grains:—

Selections	Class of grain	Years the tests have been repeated	Weight per measured bushel	Average yield per acre per annum	
				Straw (tons)	Grain (bushels by weight)
Large seed ..	Oats	7	33.2	1.9	62.0
Medium sized seed	,,	7	32.2	1.8	54.1
Small seed ..	,,	7	31.8	1.8	46.6
Large plump seed ..	Barley	6	49.5	1.5	53.8
Small plump seed ..	,,	6	48.8	1.5	50.4
Shrunken seed ..	,,	6	49.1	1.4	46.0
Broken seed ..	,,	6	48.6	1.3	43.2
Large plump seed ..	Spring Wheat	8	59.1	1.4	21.7
Small plump seed ..	,, ,,	8	58.3	1.3	18.0
Shrunken seed ..	,, ,,	8	56.9	1.2	16.7
Large plump seed ..	Winter Wheat	6	59.4	2.6	46.9
Small plump seed ..	,, ,,	6	59.2	2.2	40.4
Shrunken seed ..	,, ,,	6	59.1	2.1	39.1
Split seed ..	,, ,,	6	54.2	.6	9.3
Large seed ..	Peas	6	56.3	1.3	28.1
Small seed ..	,,	6	56.3	1.1	23.0
Sound seed ..	,,	9	58.1	1.4	29.2
Split seed ..	,,	9	57.9	.6	10.2
Large seed ..	Spring Rye	6	53.3	2.0	26.0
Medium sized seed ..	,, ,,	6	53.3	2.0	24.4
Small seed ..	,, ,,	6	53.5	1.9	22.3
Broken seed ..	,, ,,	6	52.8	1.6	16.9

These results are of special interest to practical growers. It will be seen that only one year's selection of seed grain has a marked influence on the resulting crop. In every instance the large plump seed gave a greater yield of grain per acre than medium sized, small plump, shrunken or broken seed. In the average of the six classes of grain the large plump seed surpassed the small plump in yield of grain per acre by 18.8% and in the average of the three classes of grain, namely, barley, spring wheat and winter wheat, the plump seed gave a yield over the shrunken seed of 20.4%. It should be understood that equal number of seeds were used in this experiment. The results throughout show that a large plump seed will produce a large, more vigorous and more productive plant than that produced from a small plump or from a shrunken seed. The results point in a very striking manner to the great importance of removing small plump, shrunken, broken and split grain from seed to be used for sowing. With fanning mills and graders which are made at the present day the separations can usually be made with a large amount of satisfaction.

Enterprising farmers are now making use of personally owned graders or are taking advantage of mills or graders which serve the community. In the future a greater attention should be given to this important matter than it has received in the past.—*Ontario Department of Agriculture Bulletin No.* 332.

The Standardization of Farm Implements and Machinery.

The subject of the standardization of farm implements and machinery has long been one to provoke discussion. The question is an involved one, and many points have to be considered in relation to it. As is well known, most agricultural engineers make different patterns of implements and machines designed to do the same class of work, and agents usually have to stock these several types, as well as a big selection of spare and repair parts. It is, therefore, frequently asserted that if the number of types could be reduced and fewer variations in parts had to be made and stocked, the farmer might get his implements and machinery cheaper than he now does. The argument is a serious one. Obviously, on the face of things, there is everything to recommend a ruthless policy of cutting out surplus designs, until steps are taken in a practical form and then the problem is to determine what is "surplus" and what is not. A well-known firm, who make a very extensive range of ploughs, would not, for instance, go to the expense and trouble of doing so, with all the different patterns and processes involved, if they were not compelled to do it. And what compels them, and what compels makers of other lines to provide variety and alternative types, is the simple but very important fact that conditions themselves are not standardized. It might be possible to eliminate an odd pattern or two, but, generally speaking, it will be found that the various alternatives furnished by the agricultural engineer are dictated solely and wholly by the widely contrasted working conditions which prevail. Soil scientists are never tired of impressing the agricultural world with the fact that soil varies most astonishingly, and it is obvious that what might be a suitable implement under given circumstances might be the very reverse elsewhere. This applies more particularly to ploughs than perhaps to any other tillage unit, and is borne out by the comparative failure of many of the ploughs imported into this country under the stress of the War conditions. Many of those later ploughs were brought over in an unprecedented emergency, but they were chosen because of their proved efficiency in the United States. Yet the major portion of them failed simply because the conditions were against them, and they are no longer on the market. Others who designed ploughs

specially suitable for British conditions, have succeeded, which bears out the well-known fact that any sweeping reform of plough construction which will make standardization worth while is really out of the question. Again an agricultural writer of note has been pointing out that not only have tillage implements to be designed with due regard to the peculiarities of the soil and possibly of the crop but even sugar beet lifters are not the simple affairs they appear to be superficially. We can confirm this for we have seen complete reversals in effectiveness of performance on the part of the tools as different patterns have been tried under varying conditions, one class doing well under certain circumstances and being hopelessly ineffective when a modification in soil and crop has been provided. Standardization therefore might safely be written down as "a young man's vision and an old man's dream".—*The Implement and Machinery Review*, Vol. 53, No. 635.

Some Aspects of the Present Cattle Situation in India.

By G. S. Henderson, n.d.a., n.d.d.,

Imperial Agriculturist, Pusa.

There is much confusion in thought even among enlightened people of India concerning the cattle problem, though cattle generally enter into the life of the people to a much greater degree in India than in most countries, due largely to religious sentiment.

Compared with the productivity of the country there is a very large population of cattle, the majority of which are of an exceedingly low grade. The greater majority are of such quality that nowhere else in the world would they be allowed to exist. Cattle rearing is largely divorced from agriculture and this along with the general uncertainty of the rainfall accounts for the low standard of fertility which is found over the greater part of India. There are sufficient exceptions to show what can be done with better feeding and with better selections.

Probably some of the better types of cattle which still survive are the results of the breeding and feeding by itinerant graziers. Such breeds as the Red Karachi, Sahiwal and the Gir have been evolved by tribes which were separated from other parts of the country by natural circumstances, and promiscuous crossing was thus obviated.

Newspaper correspondents, public leaders, etc., frequently have got a general idea that present conditions are hopelessly bad and in this they are right, but they are generally far from right in their so-called facts and in their proposed methods of improving conditions.

Usually the Government is blamed for curtailing the grazing grounds. The Forest Department is blamed for preventing the promiscuous trespass of village cattle through reserved jungle land. The Government is blamed for allowing the export of cattle and sometimes for permitting any cattle to be killed at all.

It is perfectly correct to state that a number of the ancient grazing tracts are now no longer available. Some of these areas have been turned into fertile agricultural centres by means of irrigation canals, but although the agricultural prosperity of the tract is increased, cattle rearing in many of the canal irrigation areas is very backward.

The average Indian village supports a large number of inferior types of cattle of all sizes and shapes. During the day these cattle are herded on the usually restricted grazing grounds. Frequently the male animals of all conditions run with the herd and no castration is done. During the monsoon and for some months after, the grass grows rapidly and there is plenty of food; later on during the cold weather and during the hot dry weather, conditions get worse and worse until the cattle are emaciated. Some of the cows in milk get extra food and so do also the bullocks which are used for carting and well work. Seldom are fodder crops grown, and the roughage, if obtainable, consists of dried stalks of jowar (sorghum), etc., and rice straw. Under these conditions good animals cannot be produced and it is only their inherited hardiness which enable them to survive.

An engineer with experience of India lecturing in England recently recommended the general introduction of small oil-engine plants for lifting water in wells for cultivation. He suggested that these plants would set free several million bullocks and their food. It is difficult to reconcile this opinion to existing facts. This mass of animals would simply be added to the existing hordes.

One of the great obstacles in the way of introduction of improved animal-draught agricultural implements into India is that implements, owing to the inferiority of the draught animal, have got to be cut down to so low a level that they cease to be economical.

A certain amount of improvement can be effected by slow public education in the use of leguminous fodder crops as catch crops for grazing between the staple crops. Where irrigation is available, this is an immediate possibility of the greatest value, but in tracts where the monsoon is variable or generally deficient, this procedure has not the same possibilities.

Plate XXIV is a photograph of cattle found in a pinjrapole in North Bihar. This pinjrapole is supported by public charity ; it is well run and is possibly more efficient than the usual pinjrapoles. The contrast is brought out between cattle which are probably better fed than usual in India as against cattle which are properly fed and treated on the Government Farm at Pusa (Plates XXII and XXIII). At Pusa the cattle are fed from the proceeds of a self-contained area of land ; no grain is brought from outside.

It is obvious that if religious sentiments require the retention of a vast number of useless animals, then India has to pay a very heavy price for the privilege, and the price reacts on all sections of the community and is one of the factors which keeps the average cultivator but little above the starvation limit.—*Journal of Animal Husbandry and Dairying in India*, Vol. I, Part IV.

The Deterioration of Soils.

By F. Hardy.

Natural Soils.

Natural fertile soils, such as forest soils, and prairie soils, differ from the rocks from which they were derived mainly in that they contain plant residues and in that they teem with micro-organic life. Plant residues contain considerable amounts of inorganic salts (lime, potash, phosphate,) derived originally from rock debris, and concentrated in the surface layers of the soil through the growth, death and decay of plants. Plant residues also yield a material usually called "humus" which is highly carbonaceous and highly nitrogenous. Humus provides a very suitable feeding ground for certain micro-organisms (the "nitrifier") which convert its nitrogenous matter into nitrates and other simple nitrogen compounds that can readily be absorbed by plants. Moreover, certain other micro-organisms (the nitrogen fixers), can actually maintain the nitrogen content of the soil by fixing atmospheric nitrogen in their bodies and leaving it behind when they die. For successful growth these beneficial micro-organisms require suitable conditions such as adequate air supply, adequate water supply and absence of acidity in the soil. They derive much of their food material from the soil humus. Besides furnishing salts (lime, potash, phosphate), nitrogen compounds and food materials for useful micro-organisms, soil organic matter possesses very desirable mechanical properties which confer high water retentivity and great ease of water movement of soil containing it. Hence, in general, soil fertility is directly proportional to the quantity of normal organic matter present in a soil.

When natural fertile soils are brought into cultivation by man, they at once begin to deteriorate. The removal of their covering of vegetation exposes the soils to rain, sun and wind. Erosion rapidly proceeds, especially if the land be sloping, and if no proper surface drains have been dug. The fertile top soil is partly washed away, and the accumulated salts are leached out. Sun and air encourage rapid loss of organic matter by oxidation and the conditions of micro-organic life are profoundly disturbed.

Eventually a raw, lifeless, mineral remnant of the original soil differing but little from the parent rock from which the soil was derived is all that is left. This incompromising material can no longer be described as soil.

Soil Conservation.

The art and science of agriculture aim at preventing or counteracting these disastrous changes. It is good agricultural practice to prevent soil erosion; to minimise leaching or to make good its depletions by tillage and manuring; and above all to conserve soil organic matter or to maintain its store by returning all available organic matter to the land and by burying cover crops deliberately grown for the purpose.

Soil Robbing and Soil Building.

The policy of soil robbing has led to serious economic crisis in many countries. Thus, Sir William Crookes at a British Association meeting in England in 1898, predicted a serious world famine in 1930, unless greater care were taken to lessen the soil deterioration in wheat growing countries. His warning directly led to the birth of the greater atmospheric nitrogen industry which now-a-days produces thousands of tons of synthetic fertilizers yearly. It also led to greater attention being paid to the scientific aspects of agriculture. Nevertheless in spite of conspicuous progress once more warnings of over-population and impending food shortage are being sounded. Practically all the good agricultural land available without expensive reclamation or developments in communications is already in use and the problem of soil productivity is now-a-days even more serious than heretofore. It is gratifying to learn however that analysis of crop yield statistics in Europe and in America indicate that no general decline in production has occurred since good agriculture became the rule rather than the exception (see *Journal Amer. Soc. Agronomy*, February 1926). Most authorities are in agreement that even poor and low yielding soils can be built up into highly productive soils by diligent and continued attention to the well-established principles of modern agriculture. The constructive research of agricultural investigators and the teachings

of science have undoubtedly exerted profound effects during the last half century and have resulted not only in soil maintenance but also in actual increase of production of agricultural commodities per unit of land throughout the world.

Economic Considerations.

Whilst the means to desirable ends are generally well known to present-day crop growers their thorough application in any particular area is often a difficult matter because of the restraint to activity furnished by fundamental economic conditions. The success of agricultural endeavour is gauged by the magnitude of the monetary profits. Nevertheless economic conditions fluctuate enormously from period to period and the successful crop grower must be capable of adapting his practice to prevailing circumstances. For this reason inertia and conservatism are fatal to agricultural progress, both individual and communal.—*Tropical Agriculture*, Vol. IV, No. 12.

The Need for a Village Dairy Factory System in India.

By W. Smith.

Imperial Dairy Expert.

Before dealing with this question in the light of India's requirements, it is worth while to study briefly what has been found necessary in the direction of dairy factory development in other countries in the world outside of Asia. The result of such study reveals some remarkable facts and clearly proves:—

(1) That all the more modern countries in the world outside Asia farmed by small-holders have greatly developed the dairy industry within the last half century.

(2) That all the foremost dairying countries in the world, whether farmed by large or small holders, have adopted a system of village dairy factories.

(3) That those small-holding countries which have increased their wealth by the development of the dairy industry have adopted the co-operative type of dairy factory organization.

(4) That in the countries of small-holders, in no case was any real progress made in the improvement of the dairy cattle until after the dairy factory system had been firmly established. In other words, the permanent improvement of the dairy cattle of the country was not possible until the dairy factory system had proved to the cow-owner the potential value of the heavy milking cow.

In the first place let us look at those countries of the world which have made the greatest progress in the advancement of agriculture during the past fifty years. They are Great Britain and Ireland, France, Germany, Norway, Denmark, Sweden, Holland, Belgium, Italy, Finland, United States of America, Argentine Republic, South Africa, New Zealand and Australia. Dairy development on a gigantic scale has taken place in every one of these countries, and without exception they have adopted a dairy factory system.

The most up-to-date small-holding parts of the world to-day are Denmark, Ireland, Holland, Sweden, Finland, Northern France, Northern Italy, Latavia and Lithuania, and by comparison with other Colonies, New Zealand is rapidly becoming a country of small-holders.

In every one of these countries where a great part of the land is divided into small lots and farmed by peasant proprietors, dairying has been the main line of development and the co-operative village dairy factory is almost universal.

In all the dairying countries in the world, whether farmed on a basis of small holdings or large farms, the village factory is universal, and it is a remarkable fact that in every case the establishment of the dairy factory system was the fore-runner of that great movement for the improvement of dairy cattle which has swept over the whole world within the last half century, and which in the most advanced countries like Holland, Denmark and Great Britain has more than doubled the efficiency and profit-earning capacity of the average cow. This fact when considered is only reasonable. Milk is such a perishable article, its handling for sale and its manufacture into edible and storable products is such a highly technical matter that the small producer of milk in any part of the world cannot possibly deal with the small quantities he produces and it took the village dairy factory to prove to the cow-owner the commercial value of the milch cow and the added profit which cows of improved efficiency would mean to him. Not only so, but the creamery of the village dairy factory especially when worked on a co-operative basis provided means whereby the agricultural propagandist could get into direct touch with the cow-owners and bring home to them in their collective capacity, as owners of a milk factory and in their individual capacity as milk producers, the benefits of improved cattle breeding, feeding and management.

India does not differ fundamentally from those other countries mentioned. She owns something like 100,000,000 adult cows and female buffaloes, most of them grossly inefficient as milkers and most of their owners

technically ignorant of the first principles of scientific milk production. Whenever there is sufficient milk produced to support it, we need the co-operative dairy factory in India more than in any other country to:—

(*a*) Educate our cattle owners as to the value of the milk they produce and the necessity of producing more milk.

(*b*) Secure for the milk producer the profits from the milk industry.

(*c*) Improve our methods of breeding, feeding and rearing of cattle.

(*d*) Improve our methods of handling milk for urban consumption.

(*e*) Improve our methods of manufacturing milk products.

Indian dairy factories need not be expensive or elaborate, but they must be efficient and up-to-date. In some cases they might be worked by hand power as was done in the case of the earlier creameries, in Western Siberia.

There is no use attempting to teach a cow owner in a tropical country how to manufacture a conserved and marketable product from the 10 or 20 lbs. of milk he produces daily. He cannot possibly do it successfully. What we must urge him to do is to unite with all his neighbouring milk producers and under the ægis of the co-operative movement equip, manage and work a village factory for the utilization of all the milk of the village area.

The present methods of ghee manufacturing by individual milk producers in India are so wasteful that they are costing this country a direct wastage in butter fat alone of not less than Rs.160,000,000 per year, to say nothing of the colossal waste that is taking place in the non-utilization of the by-products of ghee. There is no room in India for individual dairying so far as handling of milk is concerned, and as has been found in all those countries in the world who have developed and improved their dairy cattle, there will be no real progress made in the improvement of our dairy cattle until a system of village dairy factories is established. Beef has little or no value here. Indian cows are not killed, and consequently all our cows must be dairy cows. The inauguration of a co-operative dairy factory system throughout the country is the first and most urgent step in the direction of Indian cattle improvement. The rural cow-owner in India must be taught the money value of milk before we can expect him to make any serious attempt to improve his methods of breeding, feeding and handling the cows. This must be done here as elsewhere by means of the village dairy factory.

The Government of the Irish Free State, a country of small-holder dairy farmers, are at the present moment buying out the few proprietory

creameries in that country and converting them into co-operative organizations, so convinced are they of the value of the co-operative dairy factory as an element in the economic development of the country. India lags far behind in this matter, but she must start on right lines and she cannot afford to ignore the lessons which other parts of the world have learned in the hard school of experience.—*The Journal of the Central Bureau for Animal Husbandry and Dairying in India*, Vol. 1, Part 3.

Fertilizers for Coffee.

The following is a summary of recent work on this subject carried out over a series of years at the Porto Rico Agricultural Experiment Station, Mayaguez, and reported in Bulletin No. 31 of the Station by Mr. T. B. McClelland, Horticulturist :—

"In the experiments reported in this bulletin nitrogen, phosphoric acid and potash, singly and in combination, were applied to coffee trees through a series of years and their effect on growth and yield noted.

In a planting of 40 small plats the general trend of future performance as affected by fertilization was indicated as early as the first important crop. The production over an 8-year period showed that potash was effective in increasing yield, and that this was true particularly where nitrogen was used in additon to potash. Heavy applications of nitrogen unaccompanied by potash very adversely affected growth and fruiting, whereas the same quantity of nitrogen in conjunction with potash proved beneficial rather than injurious, trees so fertilized developing luxuriant foliage and heavy crops of fruit. The plat ranking first in yield received this fertilizer combination at the maximum rate. Analyses of the soil solution showed this plat to be higher in acidity than any in the field, thus placing coffee among the acid-tolerant crops. Growth and yield failed to show that the addition of phosphoric acid was of benefit. Growth and yield were closely correlated.

In several other series of plats complete fertilizer resulted in all cases in moderate to pronounced increase in yield. In one series the yield from the plat receiving complete fertilizer was approximately three times as great as from the check plat for a 13-year period. On this soil all three elements were necessary for maximum yields.

The size of the coffee cherry was observed to be related to the yield, a notable increase in yield being accompanied by a slight reduction in size of cherry. The only observed effect of fertilizer on size was thus indirect.

In field tests nitrogen appeared to increase early production. In various pot tests it greatly stimulated growth, as shown by a large increase in number of leaves, in weight of foliage, stem, and roots, and in height. Although the number of leaves was increased, no correlation was observed between leaf length and kind of fertilizer applied.

In both field and pot tests ammonium sulphate, applied semi-annually, proved much more effective than sodium nitrate in increasing both growth and yield in a planting of Bourbon coffee.

In co-operative experiments with sodium nitrate alone, applied semi-annually for two years on one plantation and four on another, no increase in yield attributable to its use was observed. On the latter plantation a change in fertilizer treatment involving the use of ammonium sulphate and sodium nitrate each singly and in complete fertilizer was followed by an increase in the yield of the plats receiving complete fertilizer. The effectiveness of ammonium sulphate alone was less pronounced and no benefit whatever was observed following the continuance of sodium nitrate alone. In pot tests equal quantities of sodium nitrate were much more effective when applied in small monthly rather than in larger semi-annual applications, and the addition of sulphur proved beneficial. Monthly applications of sodium nitrate with semi-annual applications of sulphur proved more effective than semi-annual application of ammonium sulphate. The latter, however, retained its established position of superiority over sodium nitrate alone in semi annual applications.

Both pot and field tests failed to indicate any benefit from liming.

It is evident that the coffee tree responds to fertilization. On certain soils a large increase in production may be expected to follow the application of suitable chemical fertilizers in sufficient quantity. The need for potash is particularly evident. This is in harmony with analyses of the fruit. Anstead and Pittock state that 'When a chemical analysis of parchment coffee, or coffee berries, is critically examined one fact at once strikes one as being prominent. Potash is a dominant factor in the mineral constituents of the coffee bean. This is prominently brought out in the ash analysis where there is more potash than anything else. This being so it is only logical to suppose that a fertilizer containing a preponderance of potash should help the coffee tree to ripen up and hold its crop.'

Either ammonium sulphate or sodium nitrate may be used to supply nitrogen, but the employment of the former is preferable, since in a majority of the tests it has clearly demonstrated its superiority over sodium nitrate in semi-annual applications.

The heavy clay soils so extensively planted with coffee in Porto Rico are for months at a time washed by heavy and frequent rains. The surface is generally steeply inclined and subject to rapid drainage. Under such conditions it is probable that much of the nitrogen from large semi-annual applications of sodium nitrate would be washed away without benefit to the trees to which it was applied.

The beneficial effect of potash and nitrogen in combination has been clearly demonstrated, but the most favourable ratio between the two remains a problem for future investigations. Until further evidence is obtained on this point, it is believed that a fertilizer for coffee should run proportionally high in potash, such, for example, as one obtained by mixing ammonium sulphate and potassium sulphate in equal parts by weight and containing approximately 10 per cent nitrogen and 24 per cent potash. This combination may prove adequate without the addition of phosphoric acid for certain soils. In other cases it may be advisable to include phosphoric acid, adding to the mixture an equal part by weight of superphosphate. It is suggested that each planter who uses chemical fertilizers for his coffee should determine the need of his soil for phosphoric acid by applying to experimental plats each of these two mixtures. The plats should preferably be adjacent and as nearly as possible alike in slope, soil, and condition of trees. The fertilizer combination containing only the two elements may be applied at the rate of 300 pounds to the acre, and the other at the rate of 450 pounds.

In the absence of definite knowledge as to the best time to apply fertilizer, applications may be made twice annually, the first soon after the termination of the collection of the crop and prior to the blossoming of the following crop, in late November or December, and the second in May or June when the new crop is in process of development. The fertilizer should be well distributed over the range of the coffee roots and incorporated with the surface soil.

Whether the application of chemical fertilizers to coffee will prove a profitable practice must depend upon the relation between cost of fertilizer and selling price of coffee. Within the period covered by the tests here reported the prices of both varied greatly. With high prices of coffee, use of fertilizers may prove profitable, and conversely, with low prices it may entail a loss."—*Tropical Agriculture*, Vol. V, No. 2.

Co-operative Societies and Some of Their Difficulties.

By Tom Lewis.

Urban societies for the purpose of trading on co-operative lines have been in existence for a considerable time, but it is only within the last few years that anything of a real practical nature has been attempted in this country so far as agricultural organization and co-operation is concerned. While the British workmen have always been the foremost in this movement, the British farmer has in the past been inclined to look upon this idea of combined trading with a certain amount of suspicion and distrust. This reluctance on the part of the farming class to join co-operative societies has proved disastrous to them in some respects, in that it has enabled the foreign farmer who has thoroughly imbibed the spirit of combination to secure markets for his produce in competition with the English growers.

Although progress has been slow, there are abundant signs that some headway is being made and throughout the United Kingdom we have to-day a number of societies which are doing excellent work. Unfortunately this is not true of all of them and it is the purpose of this essay to enumerate a few of the difficulties which militate against their success and these will be commented on briefly in the following order :—

(*a*) Insufficient investigation previous to forming a society.
(*b*) Inadequate finances.
(*c*) Inefficient management.
(*d*) Lack of support on the part of the members.
(*e*) Price policy.
(*f*) Lack of co-operation between societies.

(*a*) *Insufficient Investigation Previous to Forming a Society.*—It may be fairly easy to persuade farmers in a district to start a society by quoting examples of successful co-operation in other countries where success is due to conditions quite inapplicable to local circumstances. To be successful a society must perform a definite function and meet a particular need. These services are of two kinds—the purchase of farmers' requisites and the sale of farm produce.

A society should start with the simplest form of co-operative effort and then develop on broader lines when its financial position is more stable, and when it has gained for itself a firm hold on the trade of a district. In the case of a requisites' society the service will take the form of improving and guaranteeing the quality of requisites and in reducing prices or keeping them from rising. In performing this work the society will be faced with

keen competition from outside, and it must also be prepared to give farmers some of the long-term credit to which they have been accustomed.

On the other hand the problems of a farm produce society are more intricate. In the case of sale of produce societies, it is quite apparent that the need for investigation is an absolute necessity. The crown of success in these lies in the power to make prompt payment and in a guarantee of regular supplies of a standard quality. To sell well, a society must be able to build up a reputation for regular supplies of standard quality. Further, the collective sale of various commodities involves large expenditure as to buildings, plants, etc., and consequently a large turnover is essential and this necessitates a liberal supply of capital and the constant loyalty of farmers in maintaining a high standard of produce.

(*b*) *Inadequate Finances.*—Many societies have been formed without sufficient capital and they have either failed or their progress has been retarded. It cannot be too strongly emphasized that one of the most important factors essential to the success of a society is that it should be adequately capitalized and each member should take upon himself to supply at least sufficient funds to finance his own business through the society. It is essential that increase in membership and turnover should be accompanied by an increase of capital. Lack of capital is often responsible for failures in private firms, joint stock companies as well as co-operative societies, but the effects of failure in the case of the latter are more keenly felt than in the case of joint stock companies since their liabilities are usually spread over a large number of scattered shareholders. A joint stock company can appeal to the public by offering higher returns in the form of dividends. But in the case of co-operative societies interest on the capital is usually limited to 5% as it is their object to distribute benefits to members in proportion to their trading with the society and not to pay high interest on capital. This means that societies have evidently to be financed by farmers' own capital with the result that many are undercapitalized. Bank overdraft is not a satisfactory means of finances; it is liable to curtailment at any time and its withdrawal may cause serious inconvenience. Moreover, a high rate of interest must be paid whether the society is operating profitably or not.

(*c*) *Inefficient Management.*—Co-operative societies must realize that efficient management is necessary to successful trading. In the past, societies with few notable exceptions have invariably refused to pay salaries which would attract really proficient managers and undoubtedly many failures are attributable to this short-sighted policy.

The question of the control of managers by committees presents many difficulties. Committees may be composed of members who have very little commercial experience at their call and perhaps but very little interest in the society apart from the safety of their capital. In some cases the problem could be partially solved by the appointment of a small executive committee chosen from the more business-like members of the society.

Successful working, however, depends on the co-operation of committee and manager. The hard work of a good committee may be of little benefit unless backed by an efficient manager. But a good manager should be given reasonable freedom in conducting the business affairs of this society, and not be unduly tampered with. All that the committee should do is to keep in touch with his work and advise him on matters of general policy; it is as easy to spoil a good manager by over as by under supervision.

(*d*) *Lack of Support on the part of the Members.*—With those who have been advocates of co-operative trading in this country it has been quite common for them to place the lack of support on the part of members as being responsible for the failures of societies. While it is a recognized fact that co-operative methods and combined trading cannot be successful without loyal and unflinching support on the part of members, still when we have badly-managed societies it is hardly to be expected that persons will invest their capital in, and give support to, such undertakings. But given good and efficient management, there is no excuse for disloyalty on the part of members and much of the apathy in the past has been quite unfounded.

(*e*) *Price Policy.*—The question of what prices to charge to members or what prices to pay for produce is one which has always engaged the attention of co-operators in the past. On the whole farmers in the past have expected a society to be able to sell or buy at prices much more favourable to themselves than is justified by circumstances. It is a well-known commercial axiom that a concern entering a competitive market must gradually strengthen its position and that those who have invested capital must wait for their benefits and profits. This has been a flagrant cause of failure in societies selling farm produce, notably dairy societies. In order to attract supplies societies have been prone to buy at artificially raised prices without any consideration of the prices at which they can sell or of the costs of handling with the result that disaster is inevitable. The payment of higher prices involves a serious risk to a society unless it is well capitalized and in possession of a great deal of information as to

future prices in consuming markets. Farmers must learn to accept current prices less the cost of handling and wait for the extra price in the form of a bonus on supplies at the end of the year.

(*f*) *Lack of Co-operation between Societies.*—This is a problem needing urgent consideration by all societies and the greater the number of societies the more is the necessity for co-ordination. The importance of the problem is not so insistent in the case of requisites' societies, yet even with these it would seem that if they are to render the maximum service, there must be bulked purchase by grouped societies. The experience of the past 25 years has shown that especially in the case of produce societies, it is essential that co-operation should have a broad territorial basis. This is emphasized in the case of dairy produce and egg collecting societies which are competing against each other in the same market. The marketing system can hardly be called efficient when such a state of affairs persists, but attempts at federation in the past have hardly been encouraging.

In conclusion, however, one is inclined to the belief that the future of agricultural co-operation in this country is full of possibilities. Experience in the past has often been bitter, and the problems of the future are likely to be intricate ones which demand determined handling. But the development of agricultural education in our colleges and farm institutes and the extensions of such work to the countryside by efficient and tactful organizers is equipping a large group of young farmers for this arduous, yet beneficial, task.—*Journal of the University College of Wales—Agricultural Journal of India*, Vol. XXIII, Part 1.

Good Peanut (Groundnut) Seed—Where and How to Get It.

By W. R. Beattie,

Extension Horticulturist, U. S. Department of Agriculture.

It would be interesting to know just how many peanut growers make a speciality of saving high-grade seed at harvesting time each year for planting the following spring. There are those among our peanut farmers, and the number is far too large, who give little or no attention to the matter of providing seed but depend upon the better business judgment of a dealer or cleaner to supply them at planting time. We hear it said that varieties "run out" and that you have to get in new seed ever so often in order to keep up vigour. Every plant, like ourselves, has two distinct characters, the good and the bad, the one that tends to build up, the other that pulls down, and it is only by discouraging the latter that we are enabled to make improvement. This is especially true of

plants like the peanut, which in this country is being grown outside of its most natural environments.

Without going into a long, and to most people, tiresome discussion of the principles of plant-breeding and selection, let us see just briefly what the average peanut grower can do towards increasing yields by seed improvement. In every community there is one or more growers who are noted as the best growers, and who have the best strain of seed. There is a reason for this and the reason in nine cases out of ten is that these growers give more care and attention to the matter of seed than do their less fortunate neighbours. True enough their soil may be a little better drained or richer, but most of the advantage is invariably due to better management all round than to natural condition. Sometimes these growers receive one-half cent to a cent a pound more for their peanuts than do their neighbours, and the trade in general recognizes the superior quality of their produce. These are the men to watch and whose methods should be studied and followed for they have in most cases more correctly solved the problem than can any expert from some other locality.

With the peanut planting season not far distant, those who do not have their supply of peanut seed on hand or definitely arranged for should bestir themselves. First of all has neighbour Brown or Smith, who are the successful growers of your community any high grade seed to sell, if so, get it and it will be cheap at any reasonable price. If they have none to spare, then to the local dealers or to the seedsmen you must go and pay their price. The writer has known of cases where growers sold high-grade stock for 3½ cents a pound in the fall and at planting time bought back the identical peanuts at 6 cents a pound. But if they had kept them the rats might have destroyed them, the barn might have burned and the peanuts with it, the hogs might have gotten in and eaten them, and a thousand and one other things might have happened but did not. The story is not new, but just the old, old one of poor business methods in the peanut patch. Different indeed is the story of the grower who last spring planted two or three acres with choice seed, as a seed patch, apart from his general peanut crop and gave this part special care as to cultivation, pulling out all weak plants to be sure that their tendency, or at least their progeny did not become mixed with the better ones. We used to believe that peanuts, due to the character of their blossoms, could not cross, pollinate or mix in the field. Later observations and investigations led us to doubt the truth of this belief, and now we have every reason to believe that peanuts planted together do mix and that the influence of a scrub plant may be just as great as

that of a scrub sire or any other productive degenerate. Swat the scrub and feed the pure bred, should be the motto of the peanut grower or the high grade live peanut grower just as much as of the corn grower or the breeder of high grade live-stock.

How are we going about this matter of seed improvement is the question. First, by getting the best seed obtainable for planting our crop the coming season and, second, by looking towards a better method of providing seed for the future. Long years ago before very much had been said about adding millions of bushels to the total corn crop of this country by inducing a few more grains to grow on each ear, my father used to go through his corn field before harvesting time and tie pieces of white rags on what he considered the most typical and desirable ears of corn. Later the stock bearing these ears were cut separately and placed in a shock to themselves, or when the corn was husked the ears bearing the strings were saved in a bag carried by the huskers, and were hung in the loft over the kitchen to dry. I do not know where he got the idea, for it was the custom in the neighbourhood at that time to go into the corn crib in the spring and select from what was left after the winter's feeding, such ears of corn as looked good for seed. My father's methods would to-day be looked upon as crude indeed, but he secured results superior to those of his neighbours, and this is just what any peanut grower can do if he will take the trouble to mark a large number of extra good plants in the field and harvest them separate from the remainder of the crop. Many of those selected will doubtless prove inferior when it comes to digging them, and others that are not marked may prove to be desirable as seed stock, but the principle of selecting the best out of the crop for seed purposes is the one to be emphasized. Later when the selected plants have cured perfectly in the stacks the plants should be gone over one by one and divided into groups, one containing those having the most nearly ideal characteristics of vine and nut formation and the other that rank as second or should be discarded altogether as seed. The product of the first grade should then be used for planting a seed patch the following spring and the second lot be used as part of the seed for planting the general crop.

Next season the seed patch in which the seeds from selected hill were planted should be given good attention and all inferior or off-type plants pulled out. True enough it does seem a shame to pull out any considerable number of plants, but we cannot afford to take chances and it takes about three years to rogue out all the scrubs, provided more do not develop in the meantime. This is the principle upon which most of our better varieties of vegetables and many other crops have been

brought to their present high standard of excellence. Each season as the work of selection and improvement goes on enough of the very best seed is saved for planting the seed patch and the second or the large lot used for planting the marketable crop. Seed growers usually safeguard themselves by holding over one-half of their best stock seed each year to provide against a crop failure. Very few, if any complete crop failures occur in peanut growing, but there is always the possibility of losing the seed at planting time through excessive rains, and a portion of the best seed should be held back until the crop is established.

The object of seed improvement is to increase yields and cut down cost of production per hundredweight. Thus far we have considered the matter mainly from the standpoint of seed selection. There are several other ways that yields can be increased through the medium of careful attention to seed. It is safe to say that taking peanut fields the country over, the stand of plants is not more than 85%, in fact a field having 85 per cent perfect stand looks to the casual observer as though the stand were actually perfect. In many cases where actual counts were made it was found that the stand was less than 50% perfect. In some cases not enough seed had been used to give a full stand, but as a rule the poor stand resulted from the use of inferior seed or from that which had been shelled a considerable time before planting. Much can be gained by recleaning seed two or three times before shelling and in the case of Spanish peanuts which are to be planted in the shell it pays to spread on a table or on a sheen and pick out all the inferior pods. In many cases it is much easier to reverse the operation and pick out the best ones. Experiments have shown that under equal conditions hand-sorted Spanish peanuts planted in the shell and those freshly shelled both by hand and on the machine gave practically the same stand of plants, while those shelled more than ten days prior to planting gave poor stands. Hand-shelling, especially of the large podded sorts, is considered preferable and where the peanuts are shelled in a machine, it is important that the peas are not injured in the least, also that they be shelled within a day or two before planting.

Co-operative buying of peanut seed by an entire community is perhaps the best method of handling the proposition where the seed is to be furnished by a factory and shelled before delivery. A great difficulty and objection on the part of factory management is the shelling of small lots of seed, but if a community goes together and pools their orders, it greatly simplifies the whole matter for everybody. Under this plan the members of the local association would meet and decide upon the

day that they would want their seed peanuts to be delivered, then by an understanding with the factory the peanuts could be shelled within a day or two before delivery and gotten into the ground before they had any opportunity to deteriorate. As a rule a fraction of a cent per pound can be saved on the price where the order is placed jointly.

In communities where each grower provides his own seed or where some individual grower makes a speciality of furnishing seeds to his neighbours a community shelling machine of small size is recommended. With the organization of the peanut growers in many sections into small groups this is entirely practicable, the sheller being located on some central farm and each member taking his seed peanuts to the sheller the day before he wants them for planting. In most cases it is advisable to have the shelling done by one party. Joint ownership of the shelling machine, however, is desirable, as it makes the various members feel that they have an interest in it and a right to its use. There are now upon the market shellers of all sizes from the large capacity factory sheller down to a small hand machine that can be screwed to the edge of a table.

Some method of cleaning the peanuts after they are shelled must be employed and while it would not be advisable either on a home or a community basis to install an elaborate cleaning machine, some form of suction fan and a screen could very properly be rigged up, power being furnished from a small gasolene engine, or one which is used during the fall of the year for driving a peanut picker. There is always a way of doing this thing in the community provided there is the mutual interest and co-operation. Where mills are willing to take the farmers' seeds and shell it at a reasonable cost for the work, this is perhaps the best method, provided the mills are not too far distant, but in sections here, there being no mills the local community owned shelling plant, is to be recommended. There is this danger in the instalment of a plant of this character that some one is liable to get the idea that they can use it to advantage for shelling peanuts for market. Such is a serious mistake, as it is difficult to establish a market for shelled goods and it is better for the farmers to stick to their part of the game, and produce high-grade peanuts, properly grade them and then trust to the established cleaning industry to finish the preparation for the market and to market them.

When peanut growers make a practice of purchasing their own supply of seeds, there is always a temptation after the good seed has all been planted to put in additional acreage and to plant it either from inferior seed of their own or from seed purchased from some neighbour. This in the main is poor practice and is liable to lead into two difficulties,

first, the planting of greater acreage than can be properly cared for, and second, the planting of inferior seed. In our judgment, the aim should be to increase yields through better seed selection, the securing of full stands and better cultural methods throughout, but of the cultural methods we shall have something to say in a later article.—*The Peanut Promoter,* Vol. V, No. 3.

TO IMPROVE AGRICULTURE

READ

The Journal of the Madras Agricultural Students' Union

Published Monthly

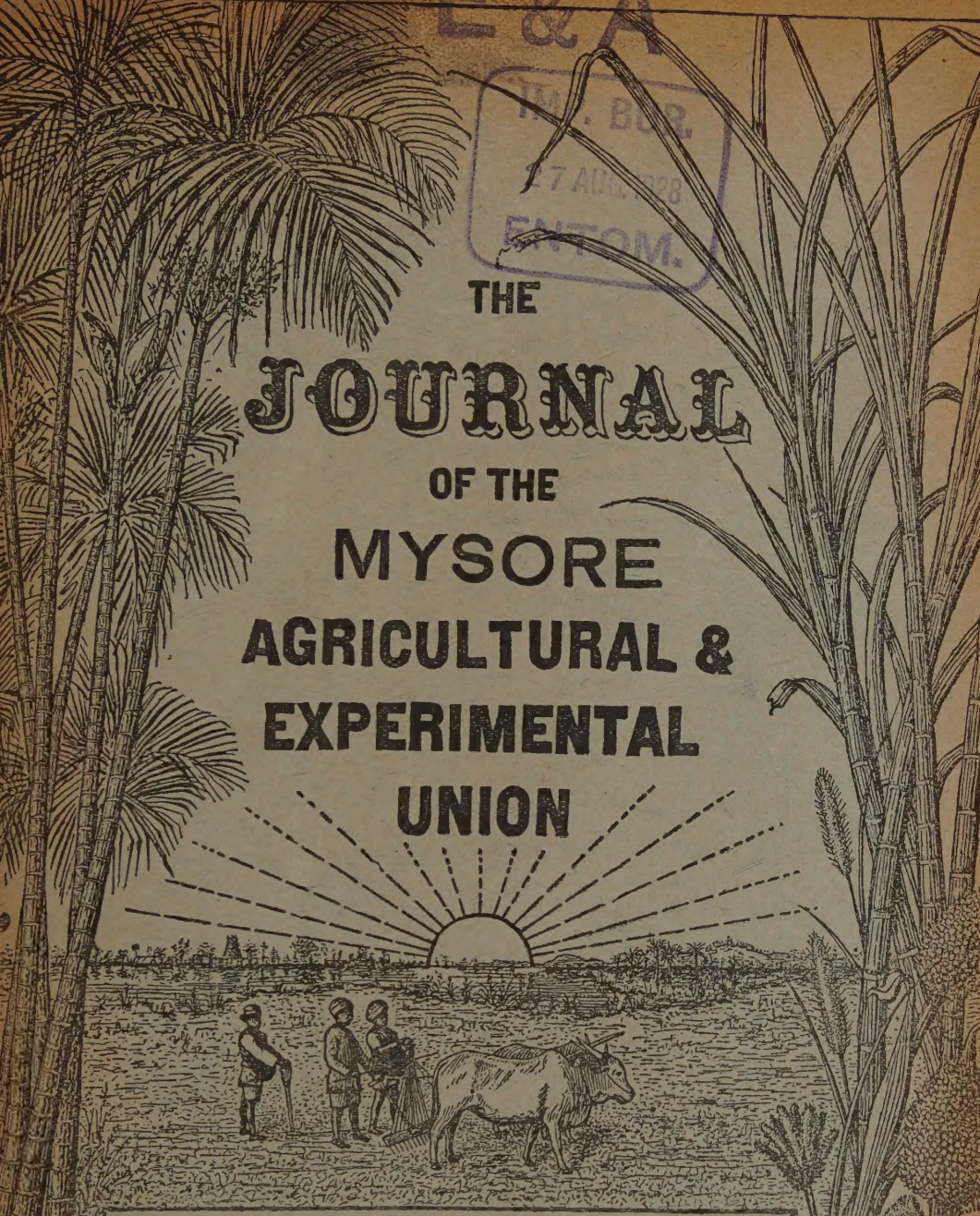
Annual Subscription, including postage, Rs. 4—0—0

Specimen Copies on request.

Apply to—The Manager, M. A. S. U. Journal,
Lawley Road P.O., COIMBATORE.

E & A
IMP. BUR.
17 AUG 1928
ENTOM.

THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION



Vol. VIII] June 1928 [Nos. 3 & 4

PRINCIPAL CONTENTS.

After Twenty Years—By Leslie C. Coleman, M.A., Ph.D.

Large-Scale Trials of Artificial Manures for Paddy on Private Lands—By B. Narasimha Iyengar, B.A., Ph.D.

The Introduction of a New Insect into Mysore—By K. Kunhi Kannan, M.A., Ph.D.

CONTENTS.

	Pages
After Twenty Years—By Leslie C. Coleman, M.A., Ph.D., Director of Agriculture in Mysore ..	125—129
Large-Scale Trials of Artificial Manures for Paddy on Private Lands—By B. Narasimha Iyengar, B.A., Ph.D., Agricultural Chemist	130—134
Fodder and Drought—By M. G. Rama Rao, B.A., Retd. Conservator of Forests	135—141
The Introduction of a New Insect into Mysore—By K. Kunhi Kannan, M.A., Ph.D., Entomologist ..	141—145
Our Coffee Experiment Station—By Leslie C. Coleman, M.A., Ph.D., Director of Agriculture in Mysore ..	145—150
Improvement of the Coffee Industry in Mysore—By B. Narasimha Iyengar, B.A., Ph.D., Agricultural Chemist	150—163
SELECTIONS—	
Seed Trials in the Laboratory and the Field—The Scope of Agricultural Research—Sugar and Alcohol from Cellulose—Farmers' Co-operative Experiments with Field Crops—Continuous Growing of Varieties without Change of Seed—Temperature and Food Requirements of Animals—Sugar Notes—Size of Seed and Seed Selection—The Standardization of Farm Implements and Machinery—Some Aspects of the Present Cattle Situation in India—The Deterioration of Soils—The Need for a Village Dairy Factory System in India—Fertilizers for Coffee—Co-operative Societies and Some of Their Difficulties—Good Peanut (Groundnut) Seed: Where and How to Get It	164—191